ARUP

BLOCKCHAIN TECHNOLOGY TIMELINE

CASE STUDIES IN THE BUILT ENVIRONMENT

MATURITY AND TECHNOLOGY READINESS LEVELS

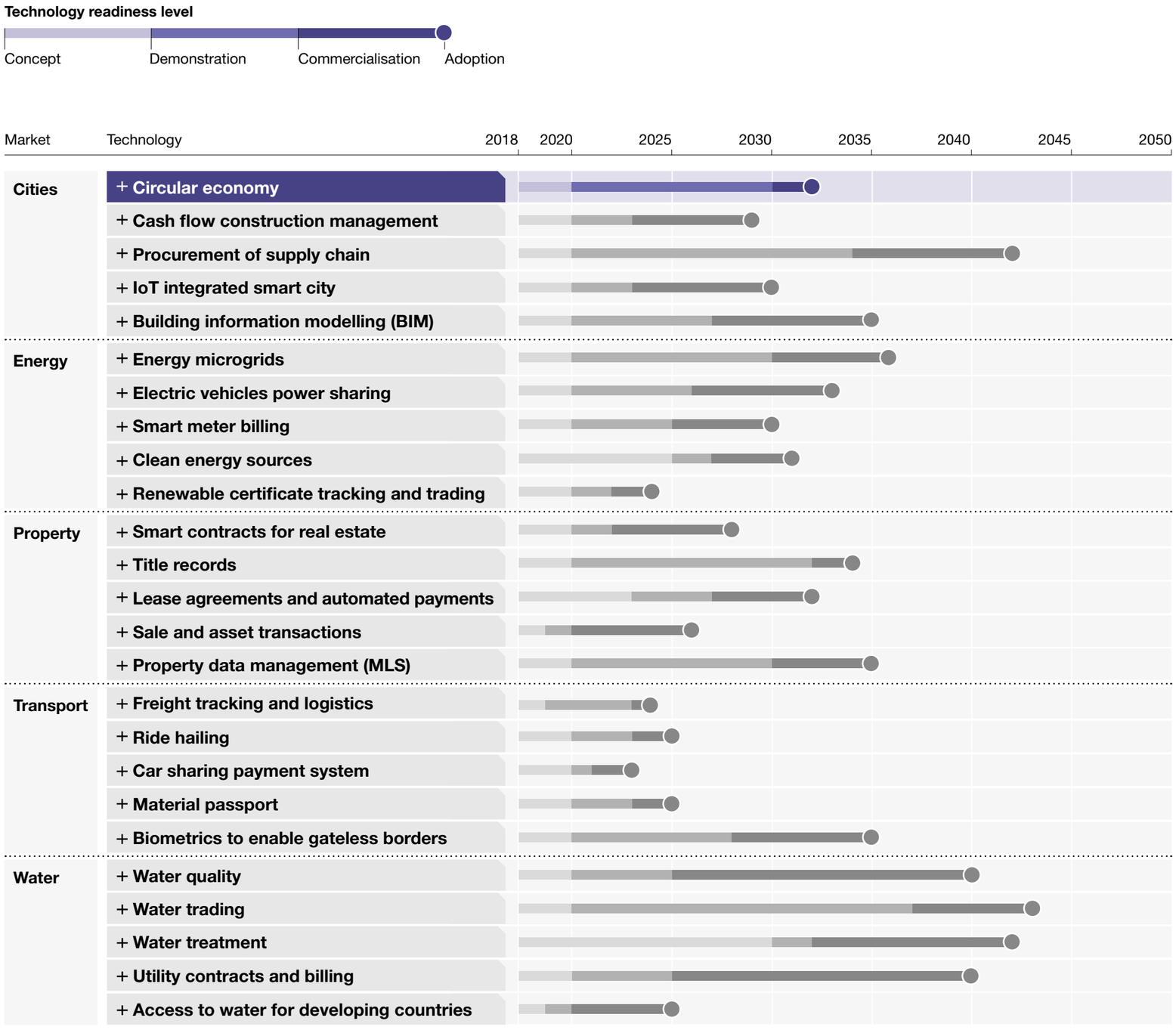
About

The blockchain technology timeline highlights emerging case studies across the built environment and examines their rate of maturity. From energy microgrids to car sharing payment systems, the timeline provides an insight into plausible timescales for a technology's development.

Methodology

The timeline was developed through comprehensive research and interviews with experts across the industry. The maturity level of the case studies is based on the Technology Readiness Level (TRL) framework.[1] Each case study estimates the year the specific case study is expected to transition through the product development cycle: from idea, concept, demonstration, commercialisation and into early adoption. Based on the interviews, a set of data points were collected with the average early adoption represented.

Timeline



Circular economy

Definition

The structure of resource consumption in the built environment is shifting. Where once consumption took a linear form, from sourcing to use to disposal — sometimes termed the take-make-use-dispose model — we now find ourselves on the cusp of a radically different ethos. The circular economy in the built environment is an increasing priority for developers looking to curb the consumption of natural resources, obviate waste and increase efficiency through the reuse, recycling and responsible sourcing of building resources. This new model will save on negative externalities such as carbon emission, increased pressures on landfill, unsustainable levels of water extraction and widespread ecosystem pollution. In addition, it will create numerous opportunities for the industry across the entire supply chain.

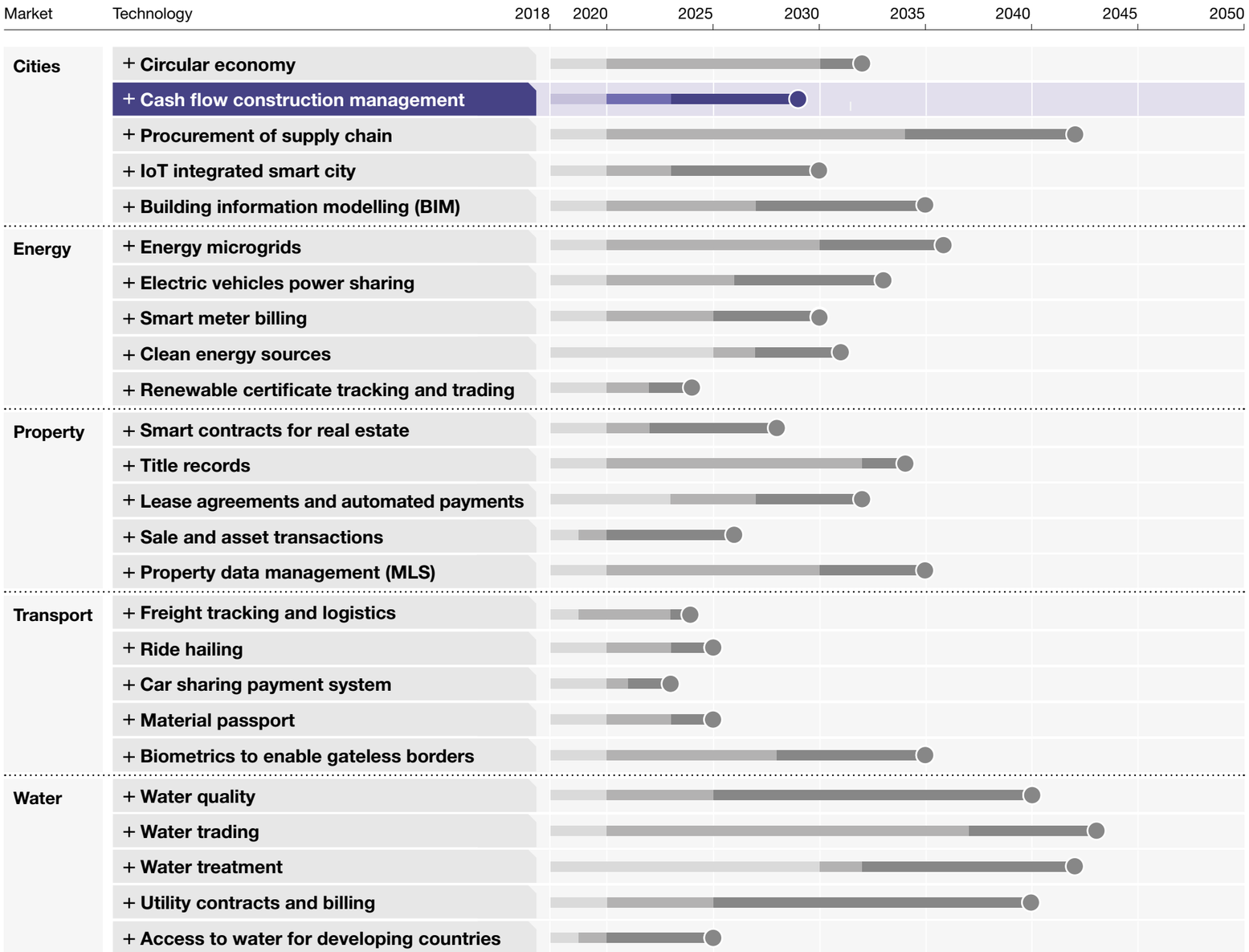
Relevance

The relationship between blockchain and the circular economy should not be understated. Blockchain will allow the effective and reliable tracking of materials, components and whole products throughout the supply and reuse chain. This has the potential to continue in perpetuity as units and elements, as well as whole products, could be reused again and again. The manufacturer, recycler and consumer can consistently and confidently assess the circularity of their products.

Case study

The theory has already found rudimentary application through Circularise, which has created an open-source distributed communications protocol for a circular economy.[2] Circularise is an open and distributed communications protocol for the circular economy. The platform allows information to be exchanged throughout the value chain, creating transparency around product histories and destinations of materials.

Timeline



Cash flow construction management

Definition

Construction is a complex, costly and inefficient process that is typically over budget and over schedule. The process is fragmented and coordination between the various stakeholders is often mismanaged resulting in lost productivity, rework, delayed progress and increased fees. Construction management is required to supervise every aspect of the project, from managing communication to inspecting onsite quality and safety compliance.

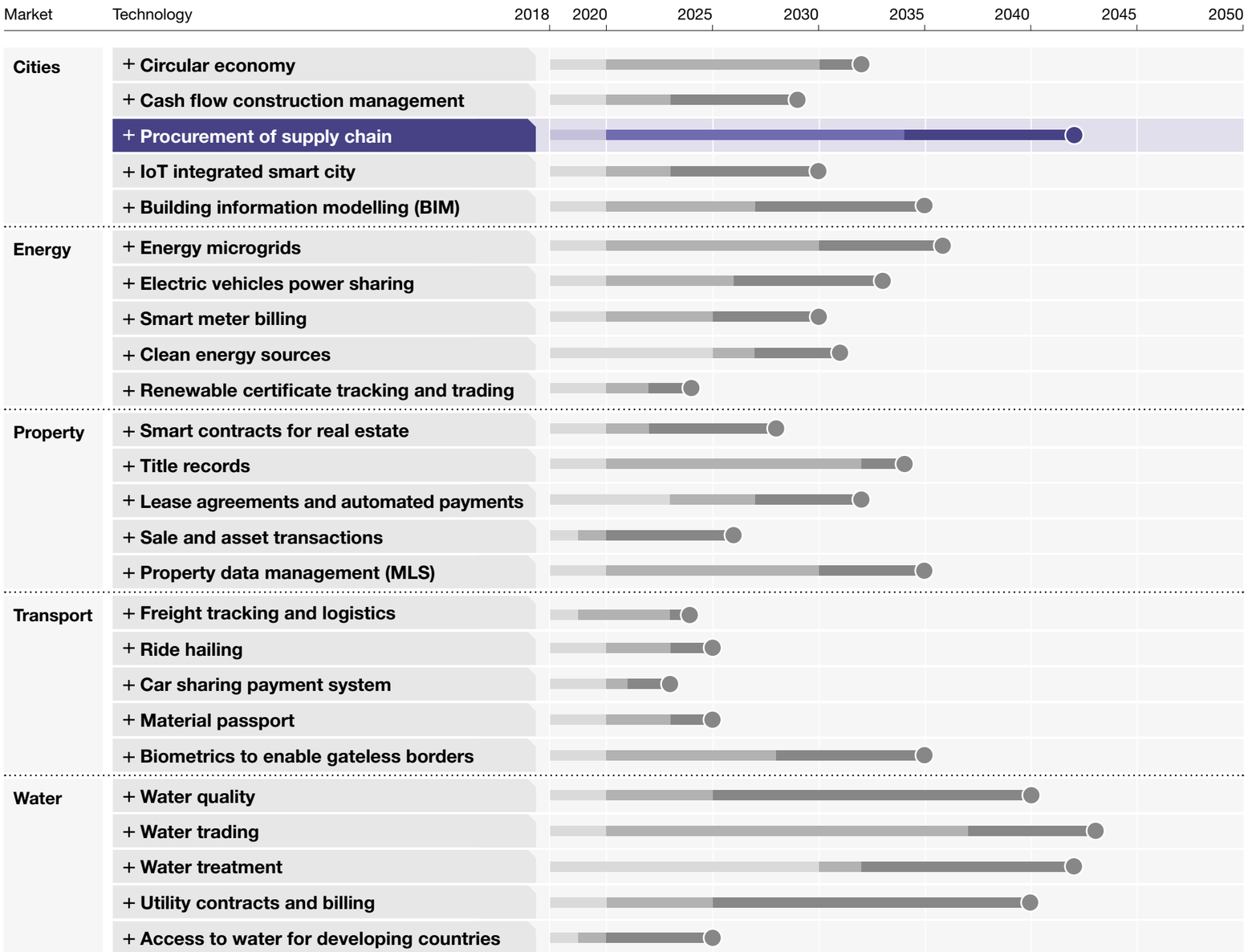
Relevance

Blockchain technology can be designed to be applied throughout the lifecycle of an asset, from design to delivery to operation. The technology can act as a bridge between all stakeholders, allowing each party to track progress with the option to set up automatic payments for work completed. This technology can help to better manage the construction progress monitoring stage, as well as solve the cash flow problem often experienced by companies.

Case study

SiteSense® — a cloud-based project site field tool — addresses these issues by creating a blockchain technology to monitor, categorise and maintain relevant resources and documentation.[3] A comprehensive list of transactions is stored in a secure, private blockchain and can be accessed by any number of stakeholders. The product is in its early stages but has the potential to change the structure of commissioning, contracting and delivery of projects at every scale, with the aim of automating and simplifying the payment process.

Timeline



Procurement of supply chain

Definition

Procurement is the acquisition of goods, services or products from external sources. Optimally, a robust procurement procedure will gain the most competitive price, alongside other benefits in terms of quality, quantity, time and location. But it is time-consuming as it is exposed to the obstacles of multiple intermediaries and there is the risk of fraudulent transactions. Ideally, procurement processes should minimise risk.

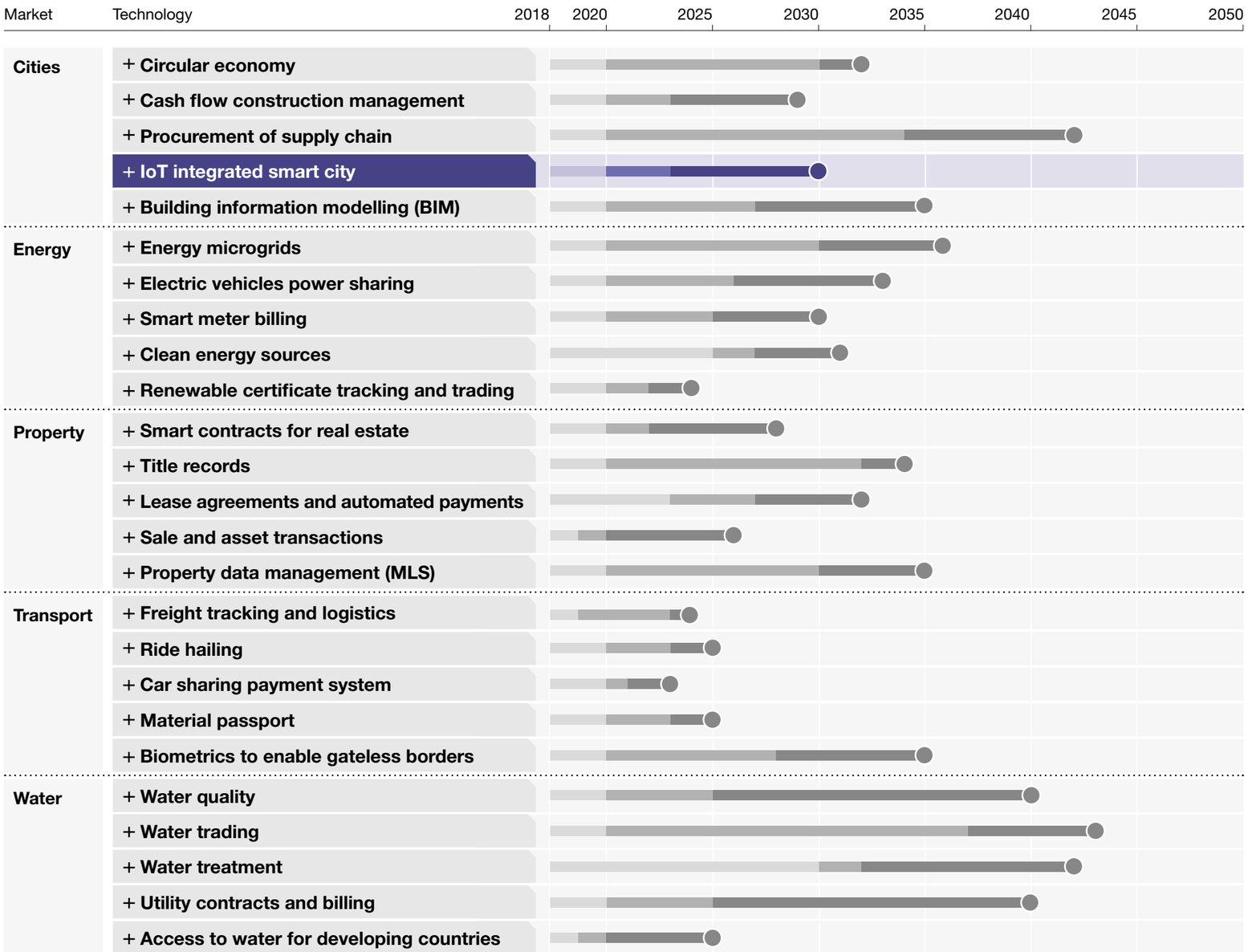
Relevance

Blockchain can improve the procurement process by facilitating the automation of trust. The parties involved can have certainty regarding identity, reputability and a price guarantee, as well as a record that cannot be changed. It can also replace invoicing. This will help companies to avoid administrative bottlenecks, such as the standard 30-day settlement term, which in turn will reduce cash flow challenges.

Case study

Retail corporation Walmart has been testing blockchain technology for use in procurement management in conjunction with IBM and Tsinghua University in Beijing.[4] In principle, the technology will allow farmers and fieldworkers to input data directly into the blockchain using mobile phones and innovative data entry tools. This will make the data available to retailers in minutes rather than days, improving the efficiency of the supply chain.

Timeline



IoT integrated smart city

Definition

The internet of things (IoT) refers to the network of physical objects, devices, appliances, etc. equipped with the ability to collect, connect and exchange data. As the IoT becomes increasingly ubiquitous with the proliferation of smart objects — from phones to cars to lights — the networks of information and functionality will extend. This will increase the potential for smart cities through the development of smaller, faster and more efficient processors.

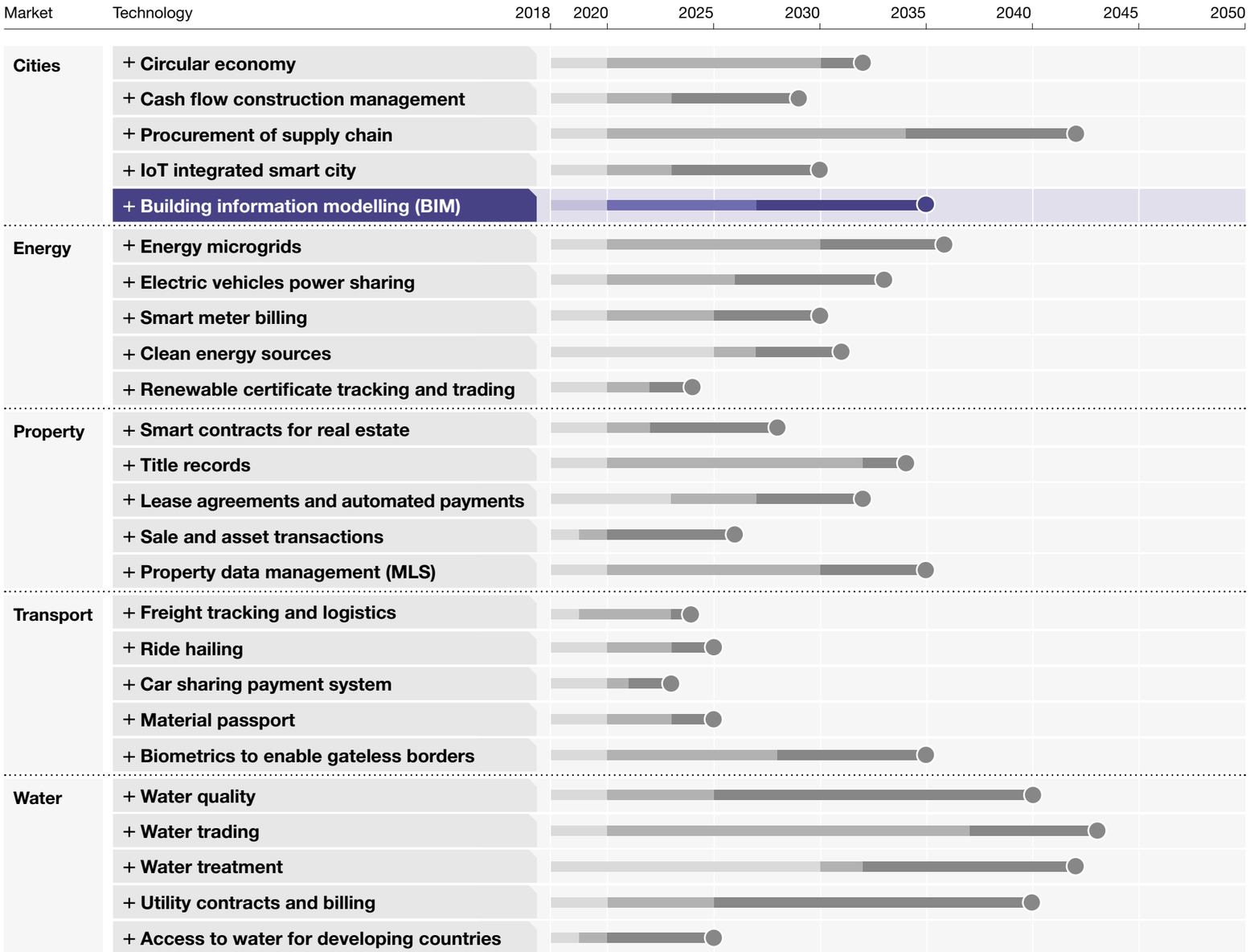
Relevance

Once the IoT has gathered and compiled the data, blockchain is the mechanism that governs how it is distributed. Combined with an immutable ledger of transactions, there is great potential to manage infrastructure and other systems efficiently. As the systems around us — transportation, infrastructure, energy, waste and water — become more connected, a trusted system such as blockchain can potentially offer a greater value yield. The technology can manage infrastructure nodes and energy more efficiently on a secure ledger of the blockchain.

Case study

Telecommunications company Nokia is offering a blockchain-powered IoT sensing service for smart cities.[5] It aims to employ the technology, utilising data analytics and blockchain, for the economic and environmental upkeep of our cities. The technology can be applied to detect environmental behaviours such as illegal construction, rubbish burning or unusual particles in the atmosphere. Nokia also sees possible applications in unifying the management systems in a smart city, and improving the roll-out of new services, for example by a city council.

Timeline



Building information modelling (BIM)

Definition

BIM brings together architecture, engineering and construction professionals under a single digital tool, enabling the coherent, cooperative and integrated design of buildings and infrastructure. It allows the construction of an intelligent 3D model for the generation and management of digital assets. It is a resource for sharing knowledge about a facility, forming a reliable basis for decision-making throughout the project lifecycle, from design to destruction. The insights gained allow more efficient planning, design, construction and management of projects.

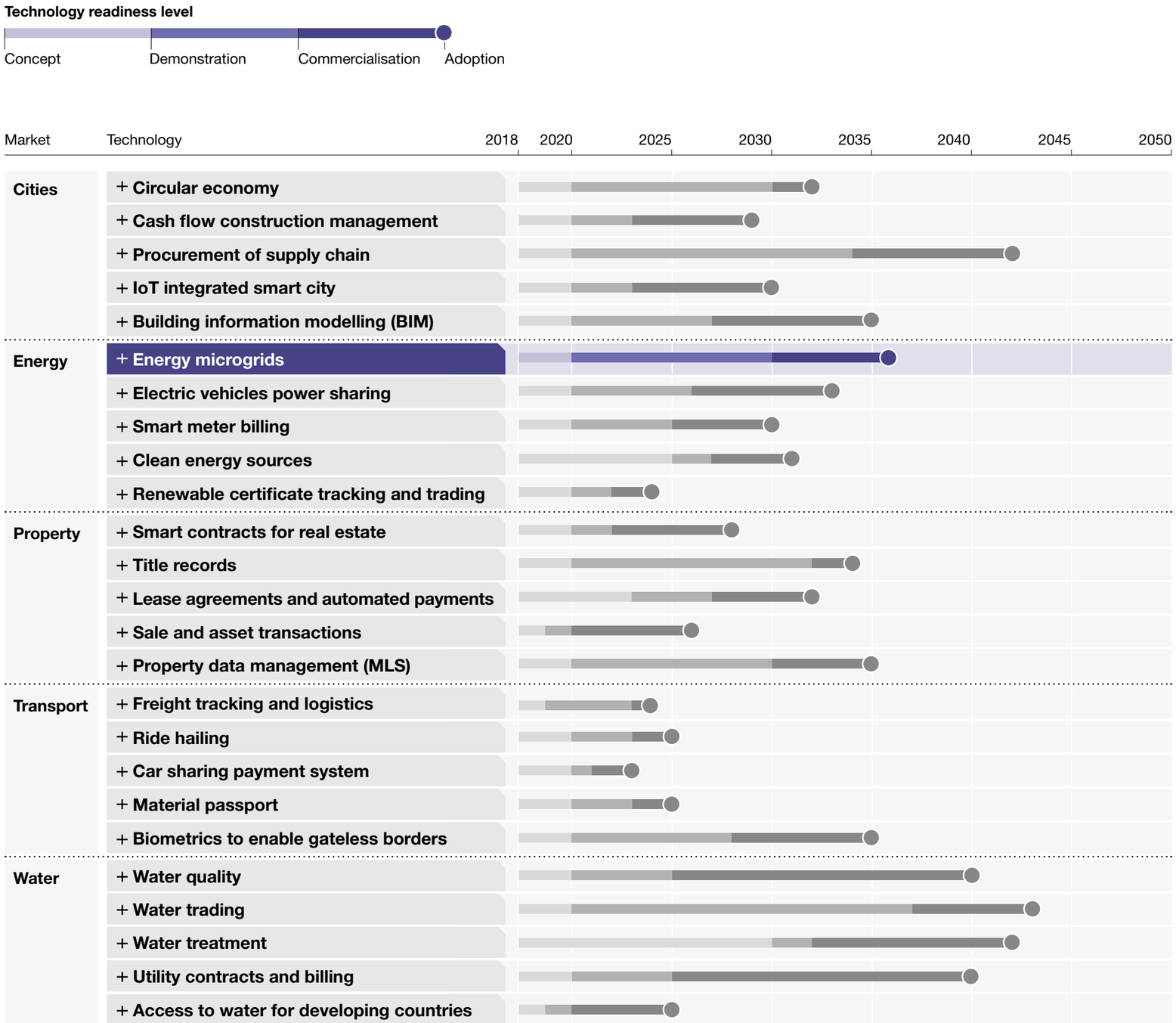
Relevance

In BIM, blockchain technology can facilitate security, liability, transferability and live data collection. A digital immutable ledger allows the project to be mapped and tracked at every stage. During the design phase, this is useful for establishing ownership of models and tracking incremental improvements and changes. Once operational, a BIM blockchain-aided virtualisation can be linked with its physical manifestation, with changes recorded internally. The data can be controlled and relied upon, both internally and externally, increasing transparency and trust. This will benefit stakeholders by reducing the opportunity for corruption, inefficiencies and contractual disputes.

Case study

In France, bridges are being designed using BIM and blockchain by tech start-up, bimchain.io.[6] Its service offers the potential to revolutionise BIM into a collaborative and legally binding tool. The benefits are in the output of a quality and accountable BIM product. Smart contracts can be drawn up and payments automated to ensure that stakeholders are committed to achieving their stated outcomes. It is also possible that insurers might reduce premiums, given the additional financial security built into projects. A market-ready product is expected in 2019.

Timeline



Energy microgrids

Definition

Micro-grids are localised energy grids that can be combined with or isolated from wider (e.g. national) grids and are capable of operating autonomously. They facilitate independence in energy supply with multiple benefits, including the tailoring of supply to peak times and allowing localised maintenance without widespread disruption. They are powered by autonomous sources, such as renewable energy turbines or distributed generators. Micro-grids can cut costs, provide backup to the main grid in emergencies and allow local energy independence.

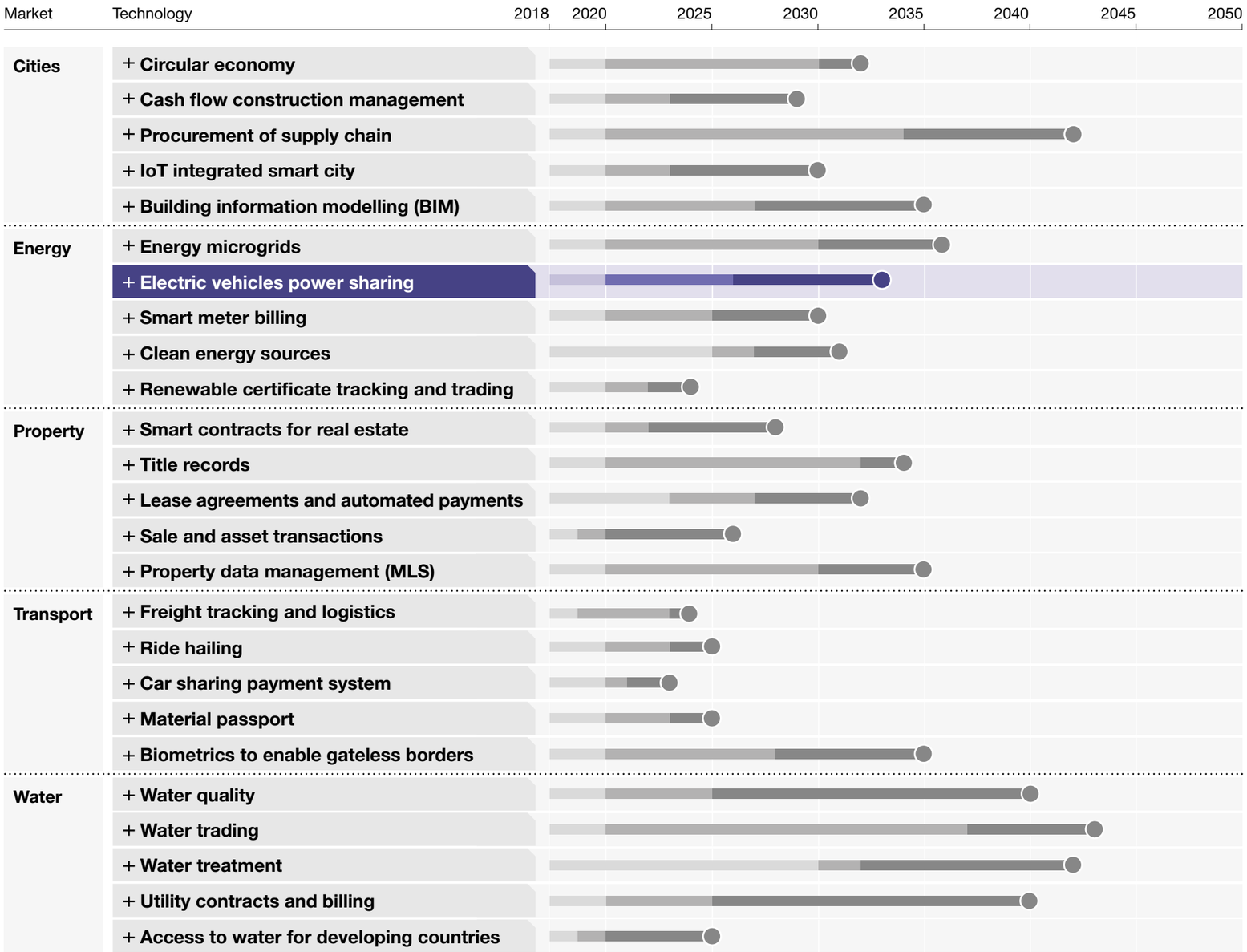
Relevance

As people are increasingly installing and building with renewables, the structure of the energy industry must adapt. Through blockchain, energy consumption and supply can be used to record transactions at specific points in time. Using blockchain technology to monitor and equalise energy supply and demand can offer reliability and control on a decentralised and shared network.

Case study

LO3 Energy has built a pilot blockchain-enabled micro-grid called Brooklyn Microgrid to create a secondary market where local consumers have the opportunity to pay local producers for energy.[7] LO3 is developing a blockchain to revolutionise how energy can be generated, stored, purchased, sold and used across all levels of the industry. Siemens has invested in the company, building its stake in the technology in anticipation of wider adoption. LO3 Energy aims to provide a decentralised grid while providing a fairer and more consistent supply of electricity to its customers.

Timeline



Electric vehicles power sharing

Definition

Electric vehicles are becoming more prevalent as climate concerns increase and government interventions step up to reduce the stock of petrol and diesel cars. However, a barrier to adoption is the range and the availability of charging facilities. This has limited electric car take-up for the most part to urban areas, but electric car owners are encouraged to share charging facilities to counteract the current technological deficit and reduce range anxieties.

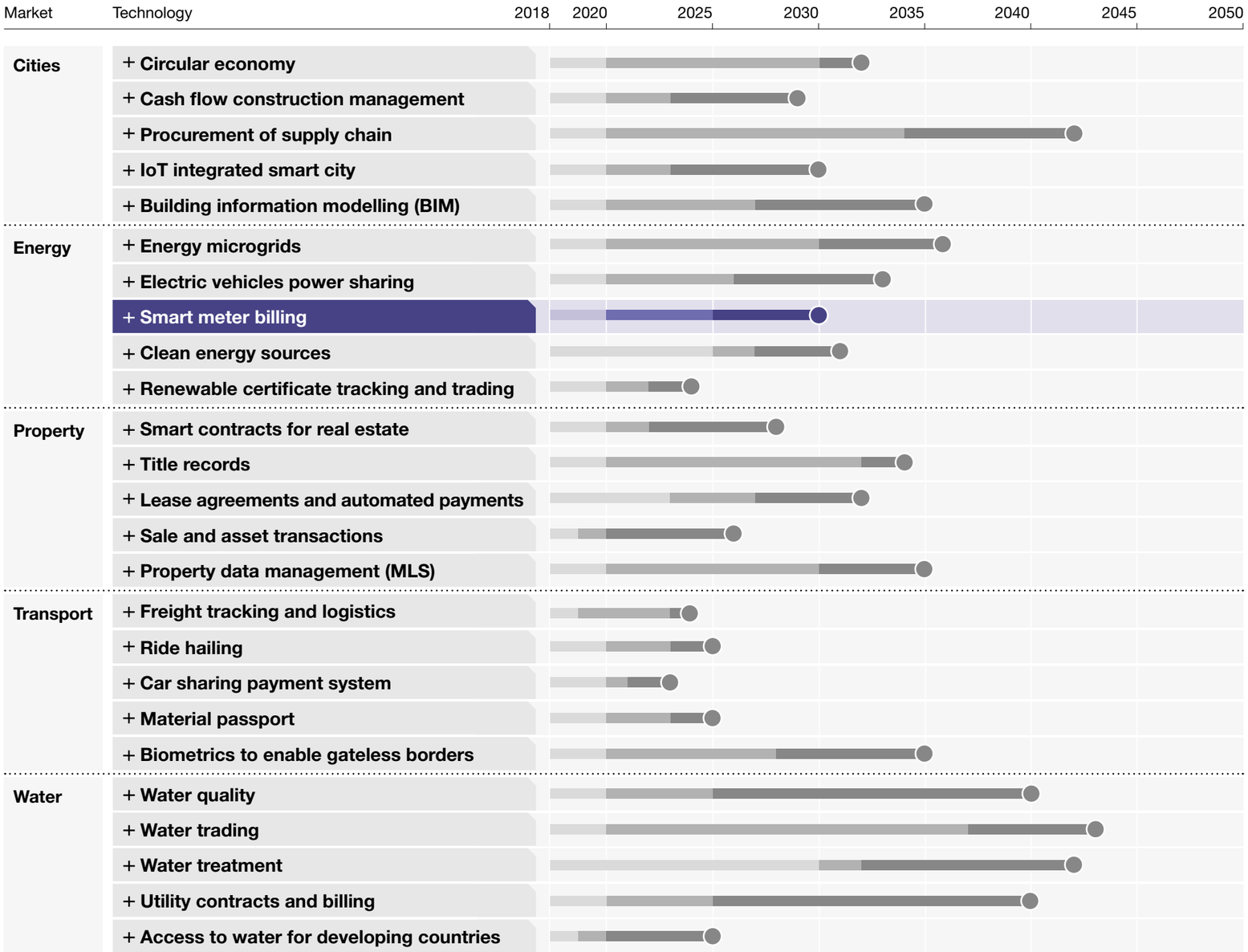
Relevance

Blockchain can be applied to the charging of electric cars as a means of recording the energy transaction (time and energy transferred either grid-to-vehicle or vehicle-to-grid) and facilitating payment between car owners and charger owners. By increasing the ease and accessibility of charging facilities in a reliable and monitorable way, blockchain may encourage the uptake of electric cars. Sharing electrical facilities also helps to optimise the grid facilities available by making more constant use of charging units, reducing the load on the grid. The model is also useful for electric car owners, who can offset their energy costs by renting out charging units to other electric vehicle owners.

Case study

Share&Charge has produced a share and charge platform utilising blockchain technology to create a decentralised protocol for electric vehicle charging, payments and data sharing.[8] Share&Charge is developing a blockchain platform to support mobility infrastructure. It connects charging assets around Germany and is implementing a pilot in the UK. It has coupled with a variety of charging station operators, such as Volkswagen, to connect electric vehicle owners to charging points. Furthermore, it has created smartphone apps and is actively reducing the range anxiety of electric vehicle owners, making electric vehicles more appealing to car owners.

Timeline



Smart meter billing

Definition

Over the next 15 years, the UK Government plans to supply smart meters for gas and electricity to every home in the country.[9] The potential benefits include reduced bills for consumers and greater autonomy over demand as consumers can be advised when it is advantageous to switch loads on or off, for example the demand-side management of electric water heating. The meters will increase flexibility in energy and gas consumption, forcing suppliers to become more competitive, and greatly enhance the resilience and reliability of the energy networks.

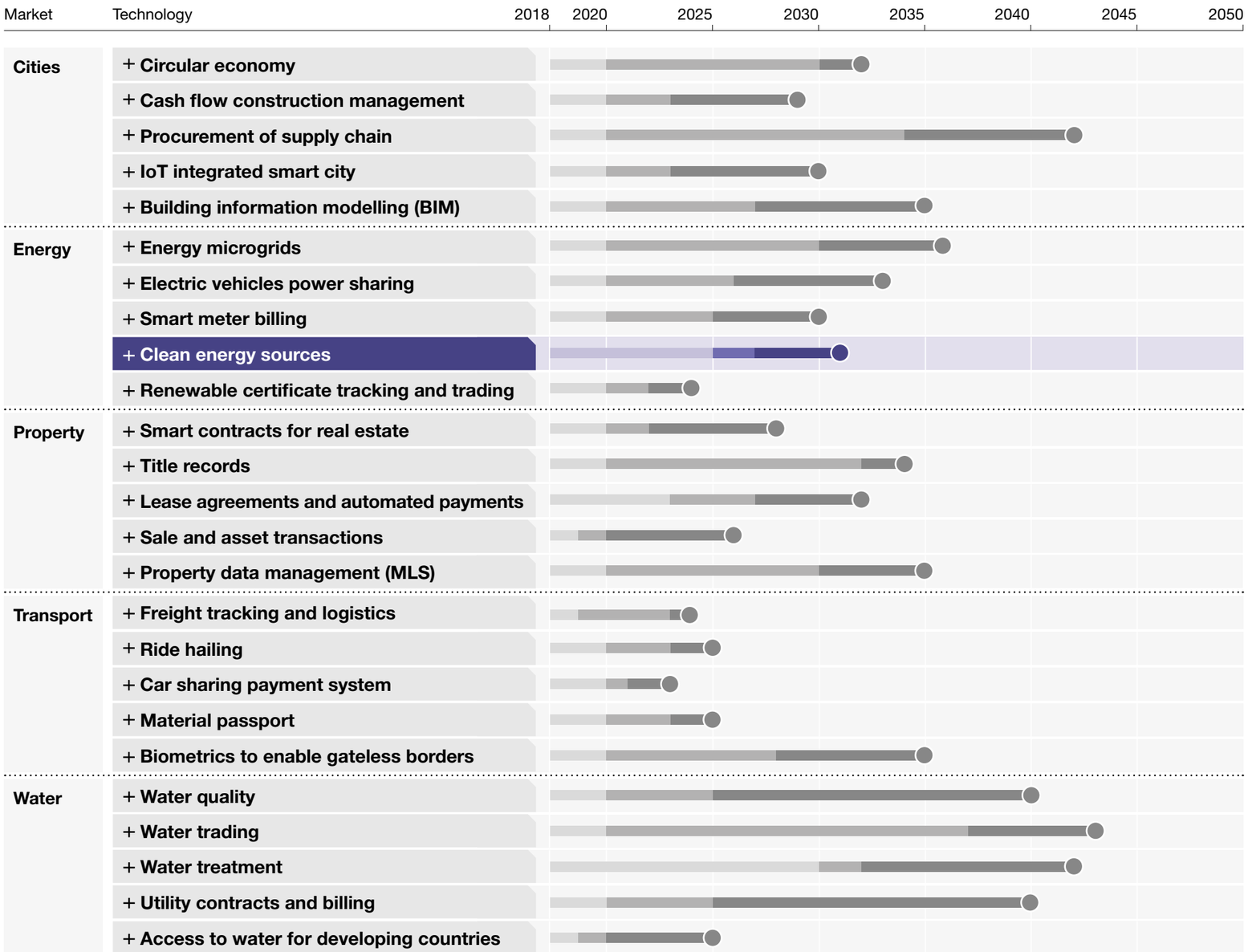
Relevance

Applying blockchain technology to this system will allow consumers to control their consumption, decrease the risk of security breaches and inaccurate billing, and provide a seamless transaction log. The advantage of using blockchain in this situation is that it provides the security and confidence to use smart meters and smart contracts to carry out transactions currently performed by people in billing departments and banks.

Case study

The German Energy Agency (dena) and the European School of Management and Technology (ESMT Berlin) have released a publication showing how blockchain technology could make smart meters more secure.[10] The technology can prevent security gaps by acting as a decentralised transaction log; however, there are still security vulnerabilities to solve. The level of sophistication and resilience is also contingent on the correct institutional and regulatory framework.

Timeline



Clean energy sources

Definition

The future of energy is shifting away from fossil fuels. It could move towards a network of local grid-connected devices — the majority of them small, with a few larger ones — providing energy through a decentralised distributed energy resource system. This is being driven by new lower-cost technologies and consumer demand for clean energy.

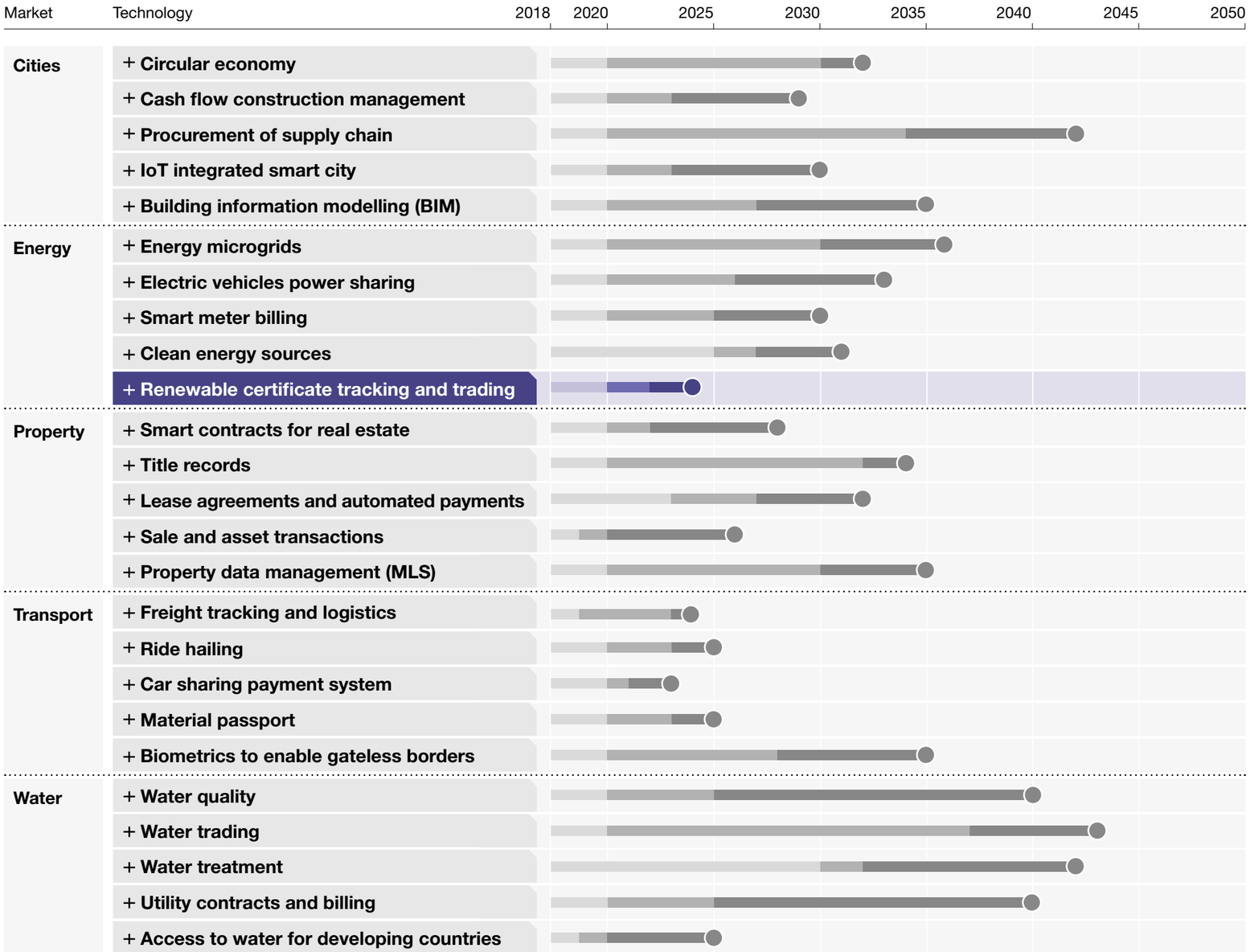
Relevance

Blockchain enables the trading of energy among decentralised sources without unnecessary third parties (note that trading can occur without blockchain). As such, this will encourage more renewable energy projects, enabling producers of renewable energy to connect efficiently with investors. The future of energy looks very different with blockchain eliminating intermediates between the energy producers and the domestic and commercial consumers.

Case study

Electron, a UK start-up, is using blockchain technology to create efficient and scalable systems for energy trading and grid-balancing solutions.[11] Electron aims to support the transition to smart grid infrastructure in this way, enhancing decentralisation, decarbonisation, digitisation and democratisation. The start-up has established a blockchain energy consortium with EDF Energy and Shell (and other big players) as part of a group to address key challenges in ensuring cheap, clean and reliable energy.

Timeline



Renewable certificate tracking and trading

Definition

A renewable certificate is proof that energy has been generated from a renewable source and can be applied to any compliance trading scheme. Urban rooftops receive significant energy from solar radiation and many authorities have started to harness this. This energy is used to heat water and run city amenities such as parking meters, traffic signals and street lighting. When the electricity is connected to the national grid, owners can offload the surplus or take it back when necessary. This provides communities with incentives to adopt renewable energy technologies and improve air quality by changing to electric vehicles.

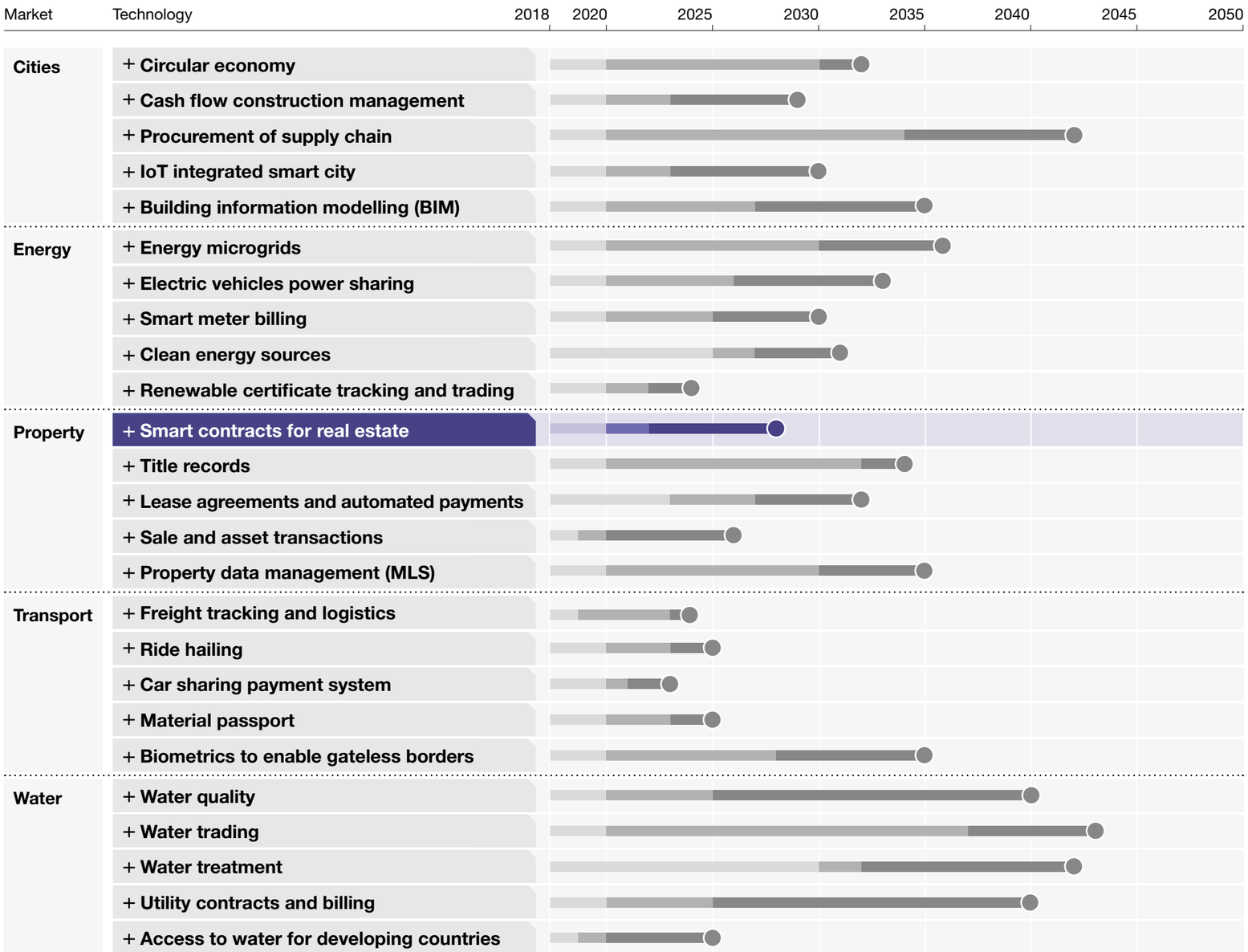
Relevance

Renewable energy can be generated for the public by mounting panels on home rooftops, erecting wind farms and other innovations. Blockchain technology can be employed to ensure that transactions are honest (by preventing double counting via the immutable ledger) and the cost of verification would be reduced by expanding the pool of participants. Blockchain can also reduce the cost of certification and eliminate the auditing process, which currently presents an obstacle for home solar panel implementers. The use of a renewable energy certificate trading platform allows buyers to trade with confidence with the embedded security, integrity and traceability of each transaction.

Case study

In Singapore, a peer-to-peer solar energy trading platform is being trialled, called Electrify.[12] This will enable trading of electricity from renewable sources, such as solar power, by lowering the traditional barriers through using blockchain. The trial aims to cut out the middlemen while driving down operating costs, ensuring transparency of contracts and speeding up contract validation and auditing.

Timeline



Smart contracts for real estate

Definition

In the sale or lease of property, there is a long paper trail of contracts with multiple stipulations that need to be signed and verified by several parties. This process is time-consuming and mainly executed through paper-based signatures. Additionally, in executing contracts for real estate, there is a lengthy due diligence and identity verification process.

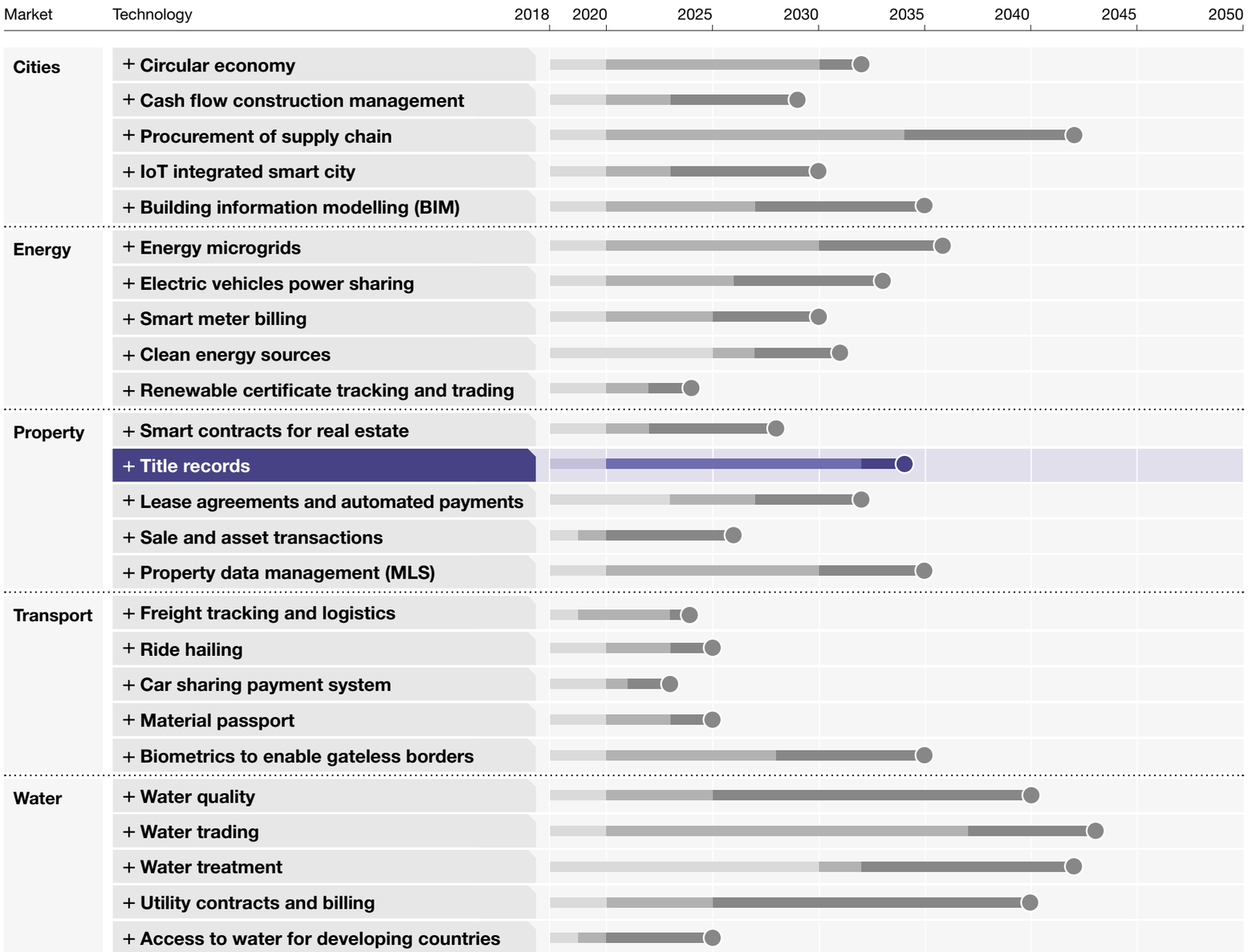
Relevance

Executing smart contracts on a blockchain will automate the transactions of the real estate process. Smart contracts have the ability to execute monetary transfers based on contingencies, as well as enable follow-on transactions such as utility accounts and payments. The blockchain technology enables a trusted verification of all parties involved in the contract and creates a seamless and direct process.

Case study

StreetWire, a real estate blockchain services company, is working to innovate and streamline the process and management of transactions.[13] It aims to deliver value to users through data management and smart contracts. Using a blockchain model, StreetWire delivers an encrypted ledger covering all aspects of real estate creating a shared truth between property owners and renters, agents, investors, lenders, borrowers and recorders. Due to the verified nature of the system, StreetWire can develop faster and more secure transaction solutions for the real estate industry.

Timeline



Title records

Definition

Title records include various methods of recording information based on the conveyance of property and land ownership. Title records are accessed and used by governments, insurance agencies, real estate brokers, buyers and sellers. In a real estate transaction, there is often a transfer of ownership of a title, and there is a lengthy verification of identity and due diligence process.

Relevance

Using blockchain technology for land title management will consolidate the previously siloed and mostly paper process into an easily accessible and trustworthy resource. With blockchain, the parties involved in the title recording can both input and gather information about properties on one common reliable platform. A blockchain for title management will also provide a more secure platform for information storage and ownership transfer, thus reducing the potential for real estate fraud.

Case study

Velox.RE, a legal deed software company, has launched a pilot programme in Chicago in which it aims to make real estate peer-to-peer and transparent.[14] In the programme, velox.RE transferred ownership of real estate through blockchain and recorded the conveyance on the public record. The system works by digitising the real estate asset through the creation of a Bitcoin token, or coloured coin, to represent the asset. The asset is then transferred through the Bitcoin blockchain and the coloured coin functions as a digital deed.

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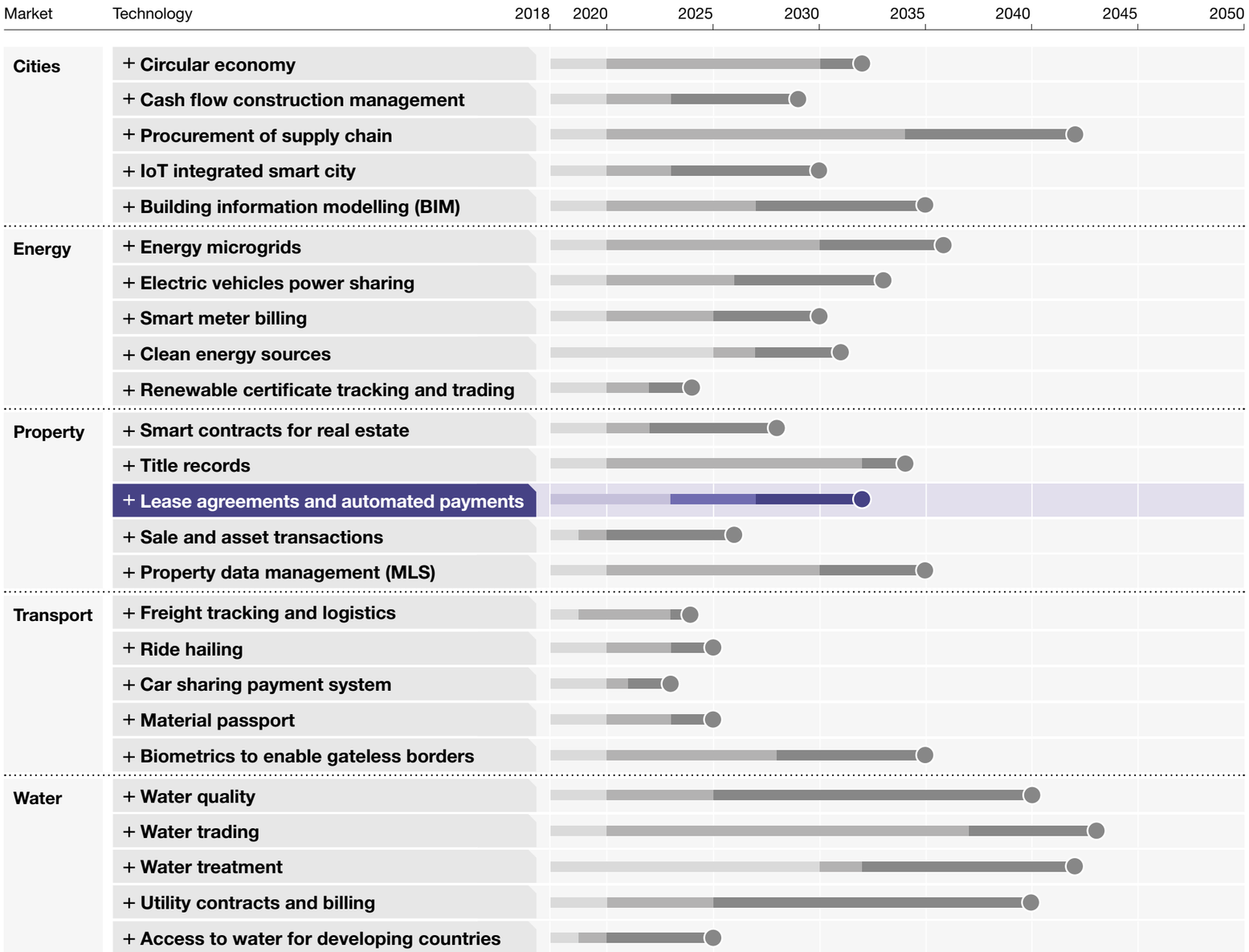


Lease agreements and automated payments

Definition

The process of executing a property lease can be time-consuming and uncertain. A property owner must perform extensive due diligence and background checks on the tenant. Other stakeholders are often involved, such as lawyers, banks and property managers. Executing the lease agreement requires paperwork transfer and signatures by stakeholders. After the execution of the lease agreement, transfer of funds including a damage deposit and rental payment occurs between the renter and owner.

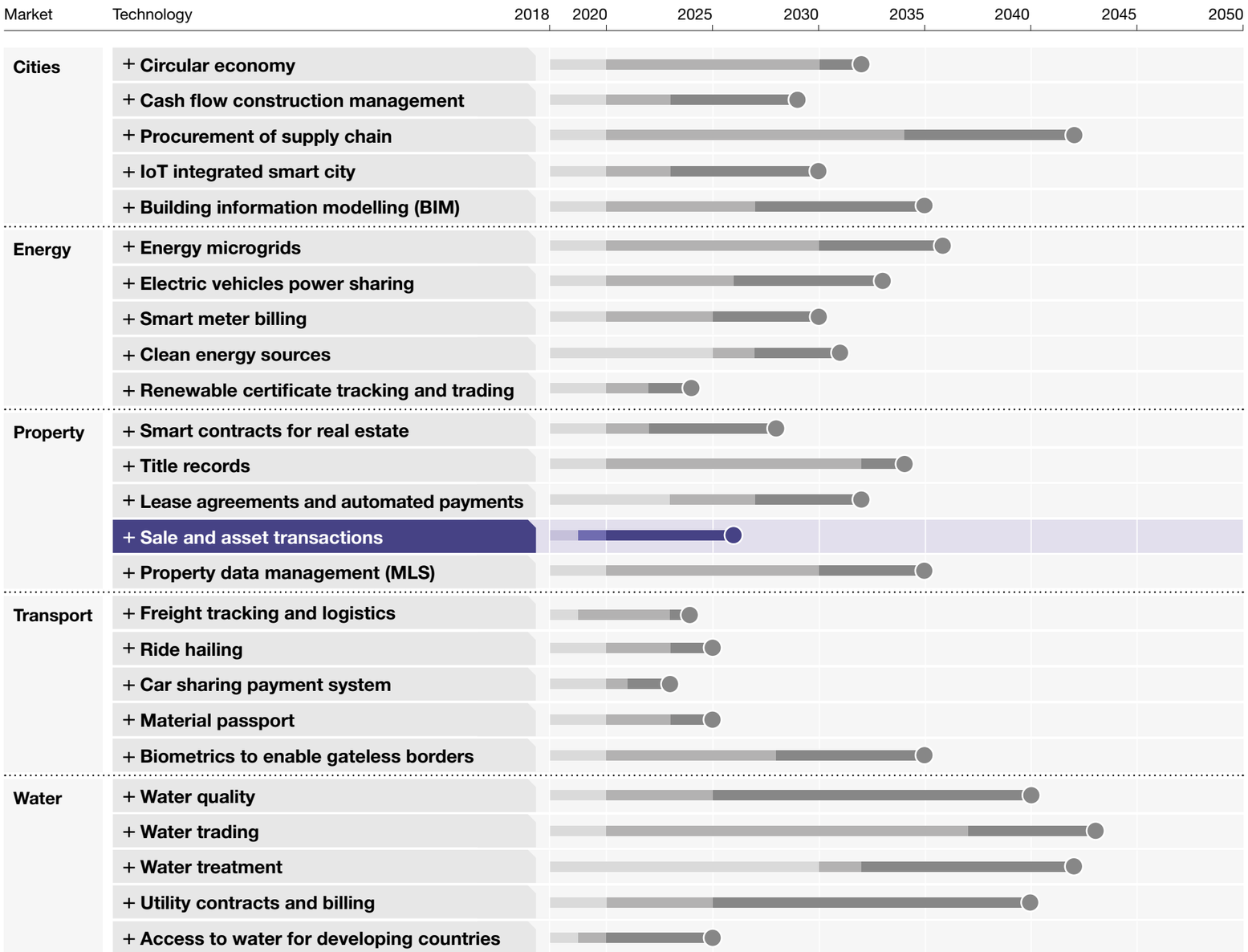
Relevance

Blockchain technology can streamline the property lease process, create comprehensive records and permit a trusted and direct transactional process between owner and renter. Using blockchain technology, payments can be made between owners and renters through an authenticated secure payment system. Renters can log maintenance requests directly to the owners, which are enabled to quickly respond and have a complete record of the property maintenance and damage. Additionally, blockchain can reduce inefficiencies and increase transparency by enabling the lease agreement, including damage deposit and contingencies, to be automatically processed through a smart contract. Finally, the blockchain will aid a more trusted transaction between renters and owners through the verification process, thus minimising the effort needed in the due diligence process.

Case study

Real estate company Midasium has created software for independent landlords and property managers to manage the cash flow of their property portfolios.[15] The software uses a system of smart contracts to automate the cash flow of a property and allows full transparency over properties. The technology delivers three key features: security of bond deposit, reconciliation of tenancy ledger, and expense management. The contract is digitally signed by both parties at the outset of the tenancy agreement and the contract is programmed for the tenant's payments, and creates a tenancy ledger for the owner.

Timeline



Sale and asset transactions

Definition

The sale of property is a lengthy process beginning with a search for a buyer or seller and ending with an executed and recorded sale. Many parties are involved, including a buyer, a seller, real estate agents, lawyers and notaries. The service of the agents, lawyers and notaries can be expensive and time-consuming. The closing of a property can be an intimidating process for buyers.

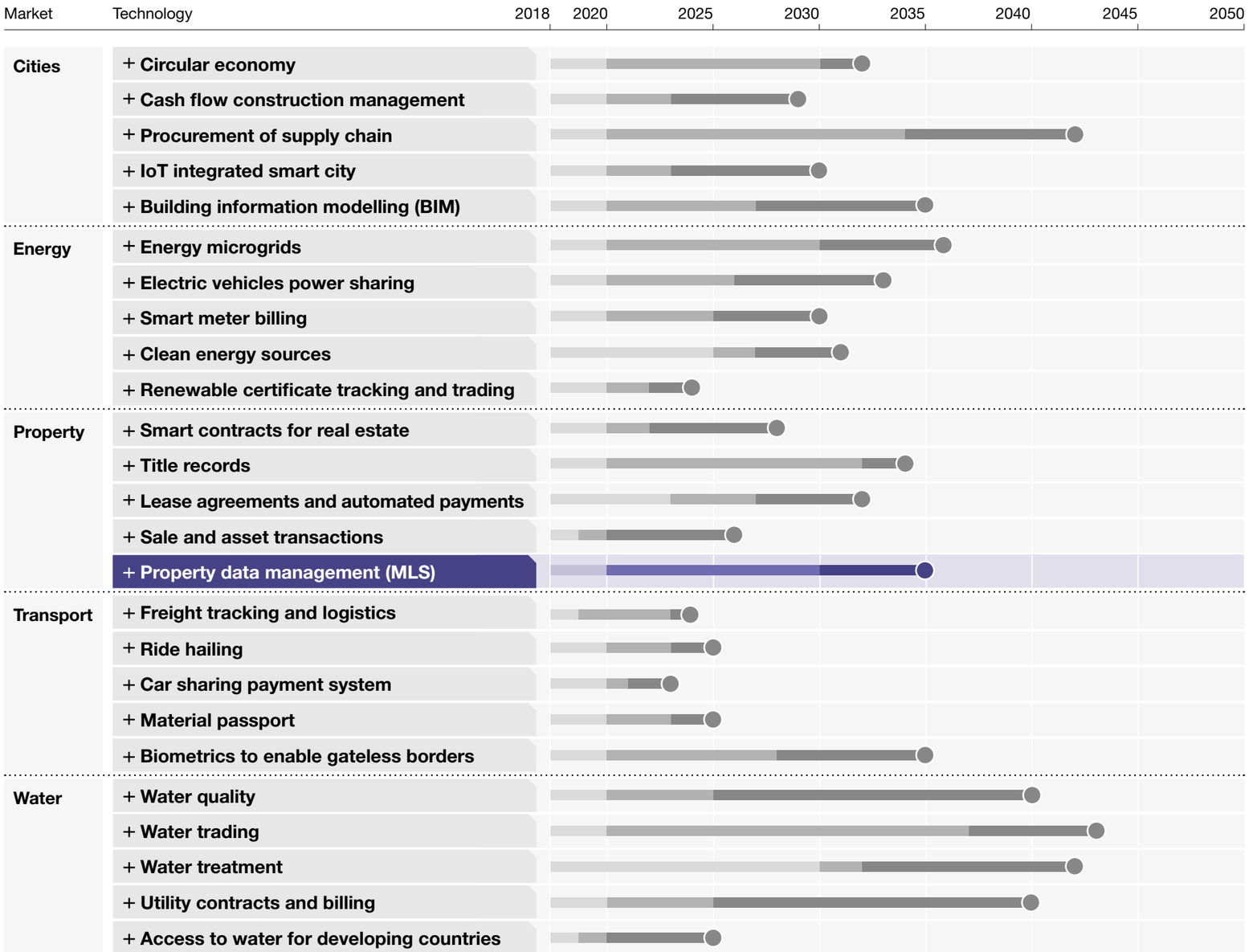
Relevance

Blockchain technology can enable the sale of property directly between buyer and seller, cutting out the middlemen and benefiting both parties financially. Additionally, the immutable ledger created by blockchain will securely and reliably track titles and ownership of the transaction process. Using smart contracts, the sale can be executed automatically based on contingencies of the sale process. Blockchain sales can enable an efficient and secure process of selling peer-to-peer.

Case study

Sweden's land registry authority, Lantmäteriet, and partners are piloting a blockchain-based process for real estate sale transactions and mortgage deeds.[16] The process connects the seller with a real estate agent and buyer and integrates the land registry and bank information. Recent demonstrations of the technology include an identification verification process, approval and execution of digital agreements, and an export of finalised legal contracts. The blockchain transaction takes the duration of the process of signing a purchase agreement through registration of the sale from four to six months down to a matter of days or even hours.

Timeline



Property data management (MLS)

Definition

The National Association of Realtors defines Multiple Listing Services (MLS) as private offers of cooperation and compensation by listing brokers to other real estate brokers.[17] MLS are databases where real estate brokers share information on properties they have listed and create partnerships with other brokers working with buyers to help sell their listings. However, today, there are more than 800 of these broker-to-broker databases that real estate professionals pay to access. Additionally, there is not a standard format for sharing property information, and the formats and information contained in the various MLS are inconsistent.

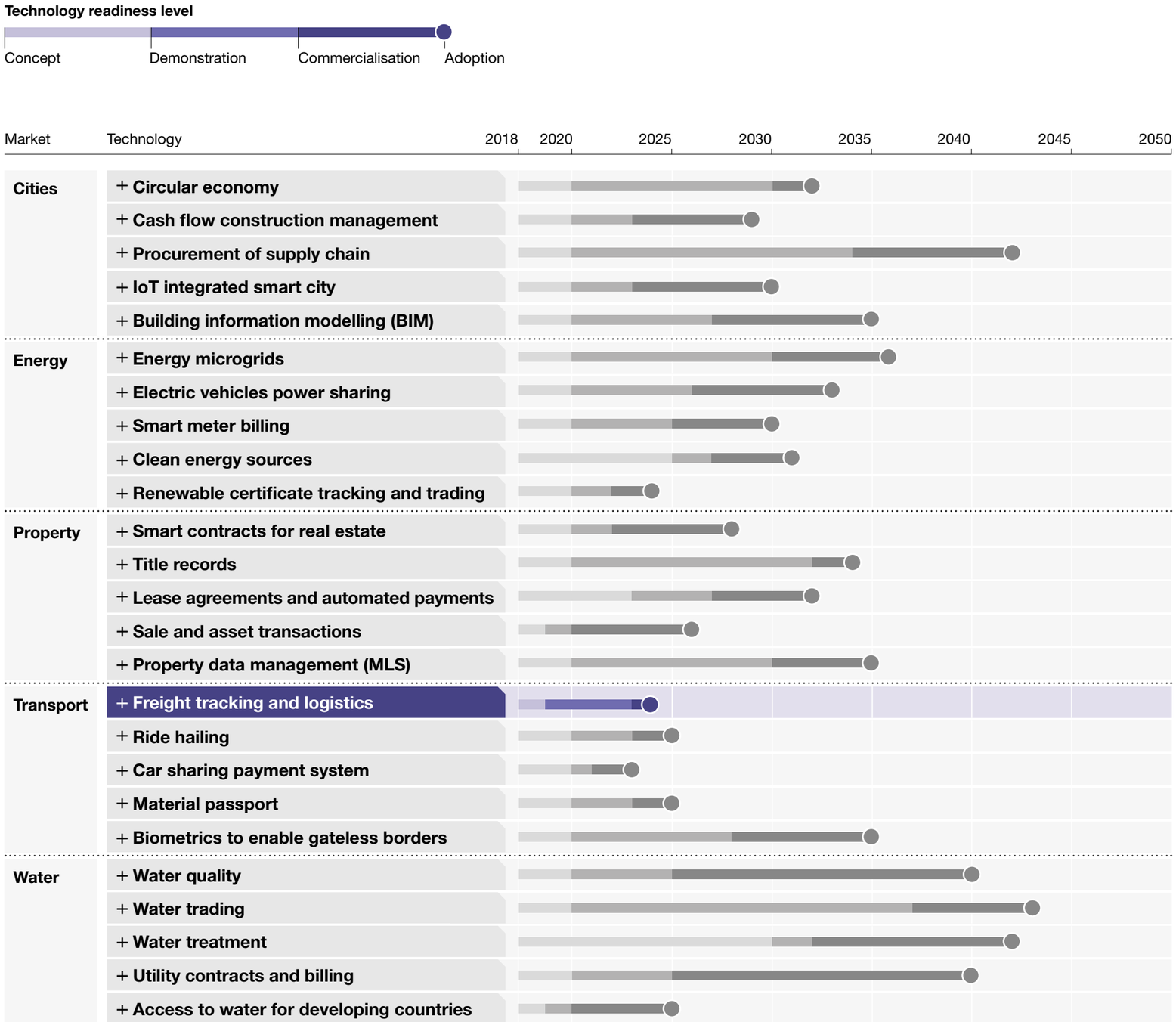
Relevance

By taking MLS information to a blockchain, the property data are decentralised from fee-charging institutions. This reduces barriers for both buyers and sellers. The aggregation of multiple sources of information will give buyers' and sellers' agents direct access to each other. Further, a blockchain will standardise the property information distributed and increase the validity and trust of the quality of information provided.

Case study

The company Imbrex is building a global real estate data exchange that is accessible to both buyers and sellers.[18] The platform has replaced the traditional MLS server and database scheme with open technologies. The structure aims to minimise fees and maximise exposure of real estate listings through a blockchain. Additionally, Imbrex's platform allows agents, firms and brokers to easily migrate information between systems and improve the quality of listing information available to buyers.

Timeline



Freight tracking and logistics

Definition

Freight shipping demand is increasing, with global freight rates 37% higher in the first five months of 2017 than in the same period of 2016.[19] In a recent survey, 42% of people said they spent more than two hours on paperwork to arrange a shipment, while 83% said they struggle to track shipments across the globe.[20] This is due to the fragmented nature of tracking and logistics, which ultimately leads to low standardisation and transparency, combined with quantities of data and various levels of technology adoption.

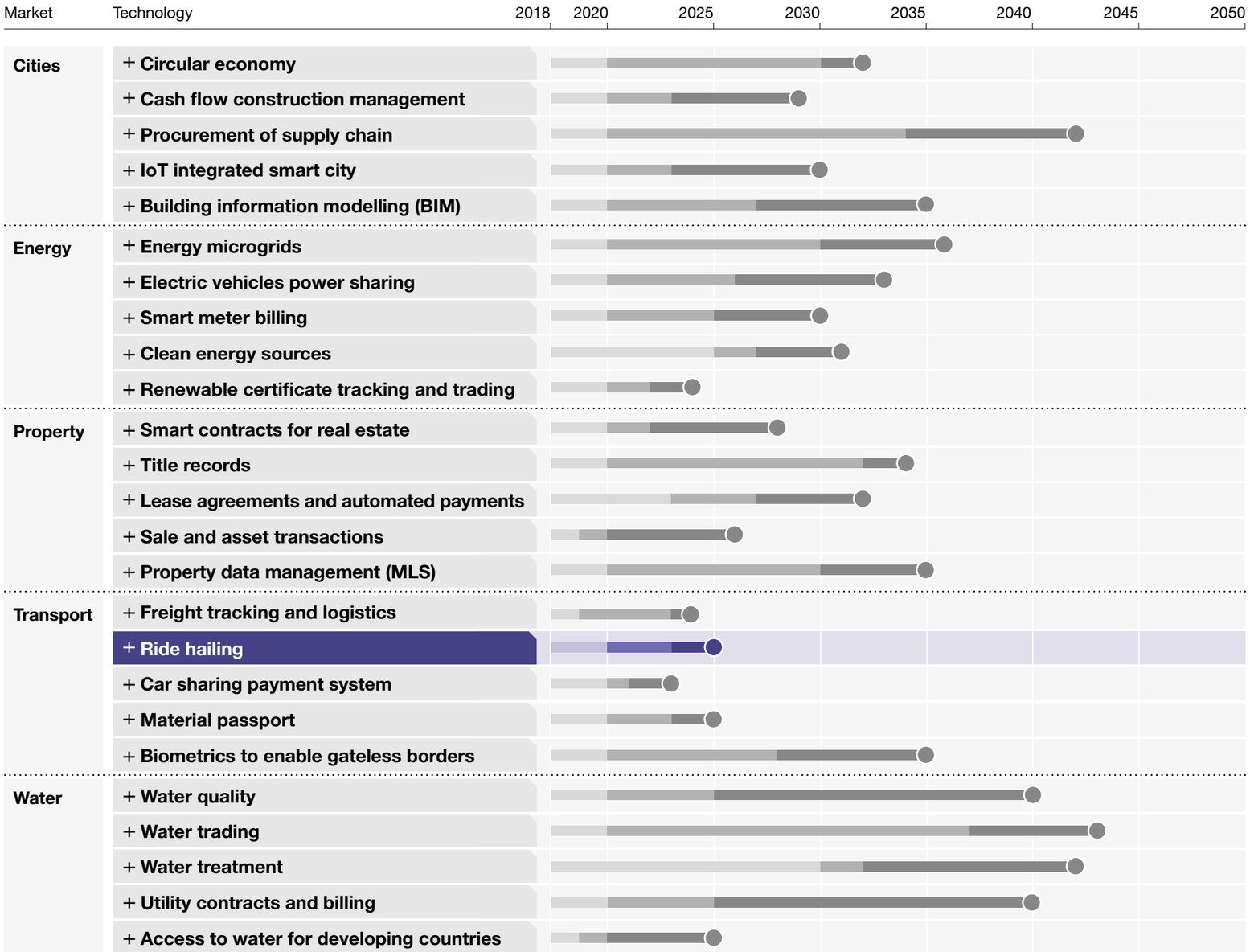
Relevance

Using blockchain, we are able to transform global supply chains by tracking, verifying and coordinating freight autonomously. A key bottleneck for logistics is the manual data entry and paper-based documentation for customs processes. Blockchain can overcome this barrier, raising efficiency, transparency and access along the supply chain. Costs can also be saved through automated systems that are error-free, raising the predictability of logistics, minimising counterfeiting, and tracking at scale.

Case study

Shipping company Maersk and IBM created a blockchain venture to digitise trading workflows and end-to-end shipment tracking.[21] The system allows each stakeholder to track the progress of items throughout the supply chain and see the status of customs documents, bills of lading and other freight data. The role of blockchain is to ensure a secure, well-documented exchange of data and transparent repository. The aim of the venture is to track tens of millions of shipping containers each year while reducing the cost of tedious manual paperwork.

Timeline



Ride hailing

Definition

Ride-hailing services have grown in popularity, with growing public acceptance of services such as Uber, Lyft and Chariot. The ride-hailing concept promises lower prices for short trips, clean vehicles with amenities, congenial service and a user-friendly smartphone app. The apps remove uncertainty, enabling users to know exactly when they will be picked up, by whom, how long the journey is expected to take and what it will cost. The platform operator ensures that drivers get paid, minus a transaction fee, offering transparency for the customer from start to finish.

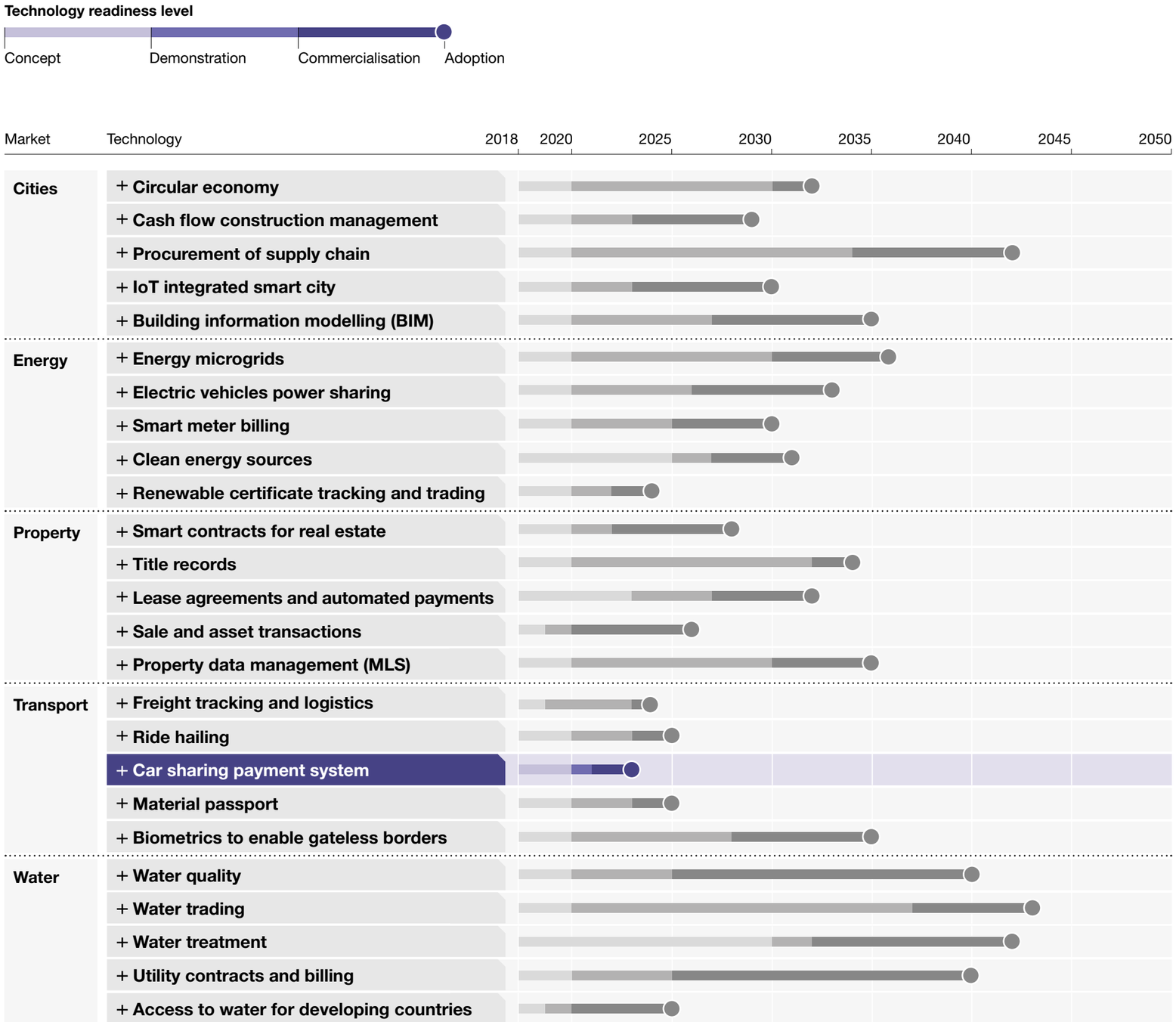
Relevance

Blockchain can enable a seamless, integrated system between the driver and the customer. Drivers will be able to receive the total journey cost without paying a fee to the middleman (such as an Uber/Lyft platform operator). This decentralised platform will create a new way of working and fair working conditions; the incentive may lead to an increase in economic growth and decrease in unemployment. The technology relies on a consensus agreement to verify the driver's identity, credentials, past records and history to provide a safe and secure environment for consumers.

Case study

TADA, a new ride-hailing app launched in Singapore by Mass Vehicle Ledger, is using blockchain to provide customers with promises of free cancellation and lower cost zero commission for drivers.[22] Pricing will be either point-to-point or metered. Security is also enhanced with blockchain, eliminating the need for a middleman. The firm has recruited 2,000 private-car drivers and aims to create a licensed community where the drivers and consumers are treated with fairness.

Timeline



Car sharing payment system

Definition

Traditional models of ownership are changing, and platform-based, peer-to-peer services are disrupting a growing number of industry sectors worldwide. The younger generation are increasingly choosing not to own cars. Car use in London peaked in 1990 at 50% of trips and has since declined to 37%; by 2050 it is projected to fall to 27%.[23] Similar trends are evident in Birmingham and Manchester. The global car-sharing market is expected to grow by 35% between now and 2025.[24]

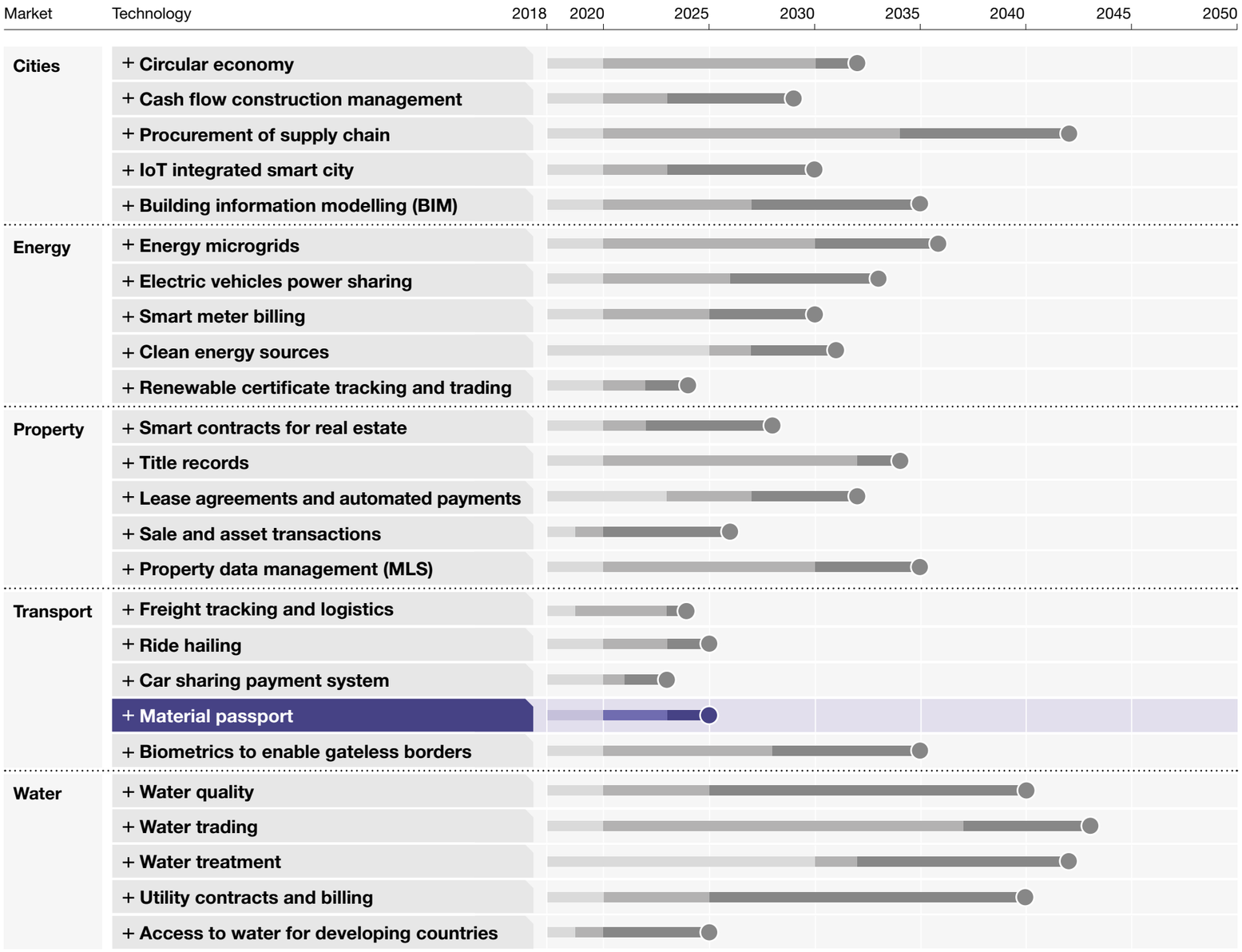
Relevance

Blockchain technology has many of the features required for a car-sharing framework, including the ability to enable secure data transfer, efficient vehicle recording and a peer-to-peer integrated trading platform. The technology has the ability for various users to gain authorisation, and to provide a database of journeys in real-time with updated traffic conditions. Blockchain could provide users with predictive and dynamic pricing.

Case study

Car manufacturer Porsche, in collaboration with software corporation XAIN, is trialling a new business model using blockchain technology in its cars for access purposes.[25] The platform is testing transactional and processing speeds, including locking, unlocking and temporary-access authorisations if the owner is locked out of their car. This innovation will enable a diversity of users to access the car, for varying amounts of time, all tracked and logged securely.

Timeline



Material passport

Definition

As industries add new models and expand their output, opportunities increase for supply chain investment. For example, in the automotive industry, the interaction between the manufacturers, suppliers and government has led to new supply chain investments requiring new technological advances to enhance connectivity and improve tracking of materials. Material passports are digital representations of physical assets. Through mass integration of sensors on both materials and vehicles, and innovations such as material passports, materials can be tracked from design, to installation, operation and end-of-life. This supports the principles of a circular economy where maximum value is extracted from products before they enter the waste stream.

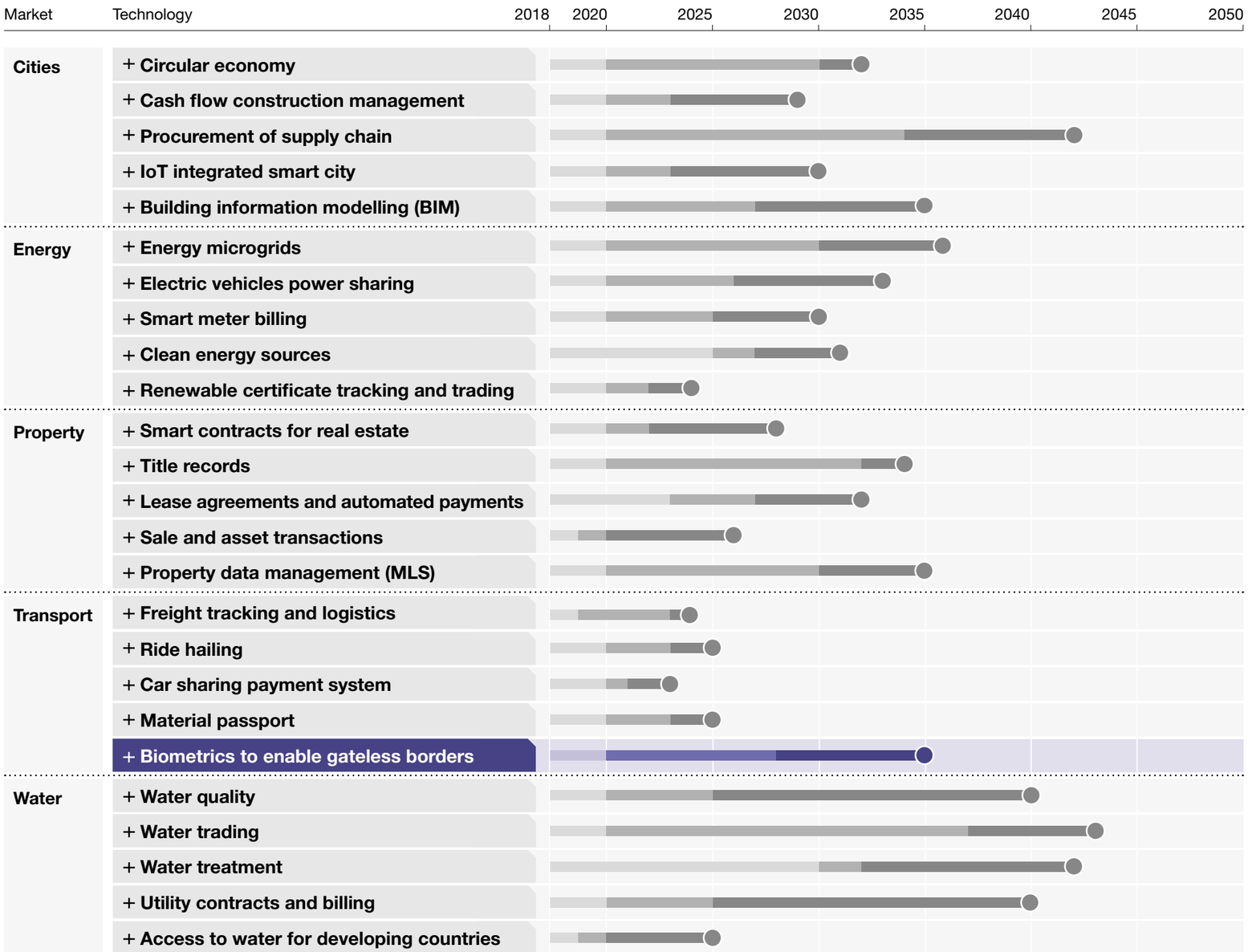
Relevance

Blockchain can enable companies to track materials using a material passport. This tracking can follow a consistent documentation of the material, including its product structure or construction. The material passport provides information on past, current and future performance, and the data can be linked to the digital asset to keep the information up to date.

Case study

Car manufacturer Renault is prototyping a digital car maintenance book by using blockchain to enable a single source of truth for each vehicle's performance and subsequent maintenance needs.[26] The collaboration with Microsoft and information systems specialist VISEO explores the technology to ensure that the car passport data are stored securely and transparently. The digital car maintenance book stores a log of all the activity concerning the vehicle in one location. For example, if the owner puts the vehicle up for sale, special permission can be granted to the potential buyer to have access to historical information, creating trust between the parties.

Timeline



Biometrics to enable gateless borders

Definition

Biometric data, such as fingerprint and facial data, are increasingly incorporated into technological innovation. For borders, such data have enabled the creation of gateless borders whereby no face-to-face contact is necessary to verify a person's identity. Therefore, passengers can expect a quicker, more stress-free journey.

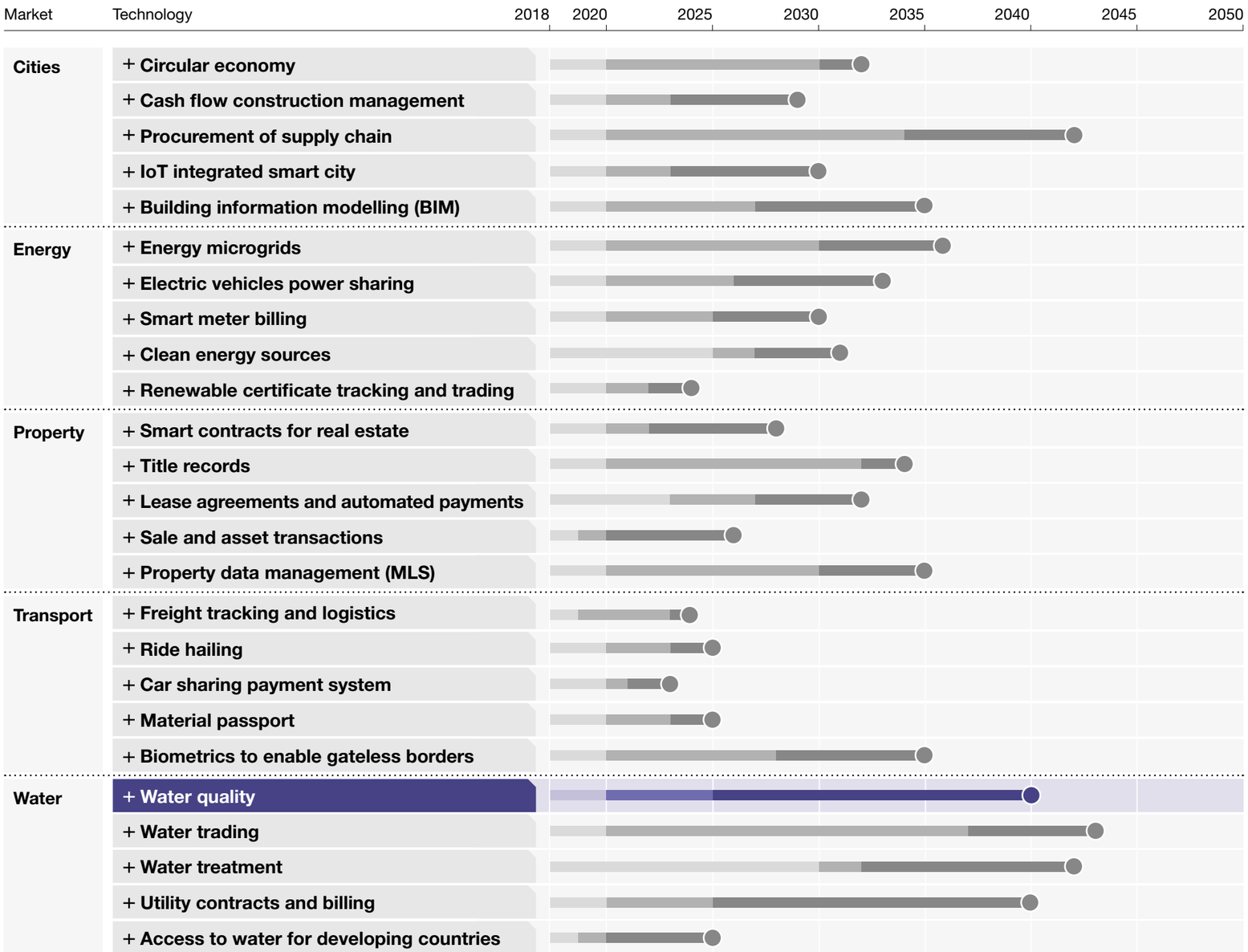
Relevance

The combination of biometric data and blockchain technology can enable gateless borders that are secure and efficient. They can help to reduce the bottlenecks in border control areas by providing secure checkpoints and allowing passengers to be processed more quickly. The future of biometrics may involve the logging and tracing of all movements of passengers and staff on to one localised system.

Case study

Dubai's government is exploring the use of gateless borders using biometric data and blockchain technology.[27] This combination offers seamless entry for residents and tourists at the airport, verifying their stay. The technology enables a digital biometric passport for passengers allowing them to register in the country without human screening. The identity trust security measure can be built into the blockchain technology allowing passengers to be screened using the verification capabilities.

Timeline



Water quality

Definition

Water quality means the suitability of water for a purpose or process. Categories include potable water, grey water, reclaimed water, recycled water, freshwater and more. Water quality may depend on a wide range of human and natural factors that affect or limit its use. Water can be taken untreated or treated using a variety of methods depending on the concentration and state of matter in it: dissolved or particulate, organic or inorganic matter. Certain physical characteristics of the water also affect the state of the matter.

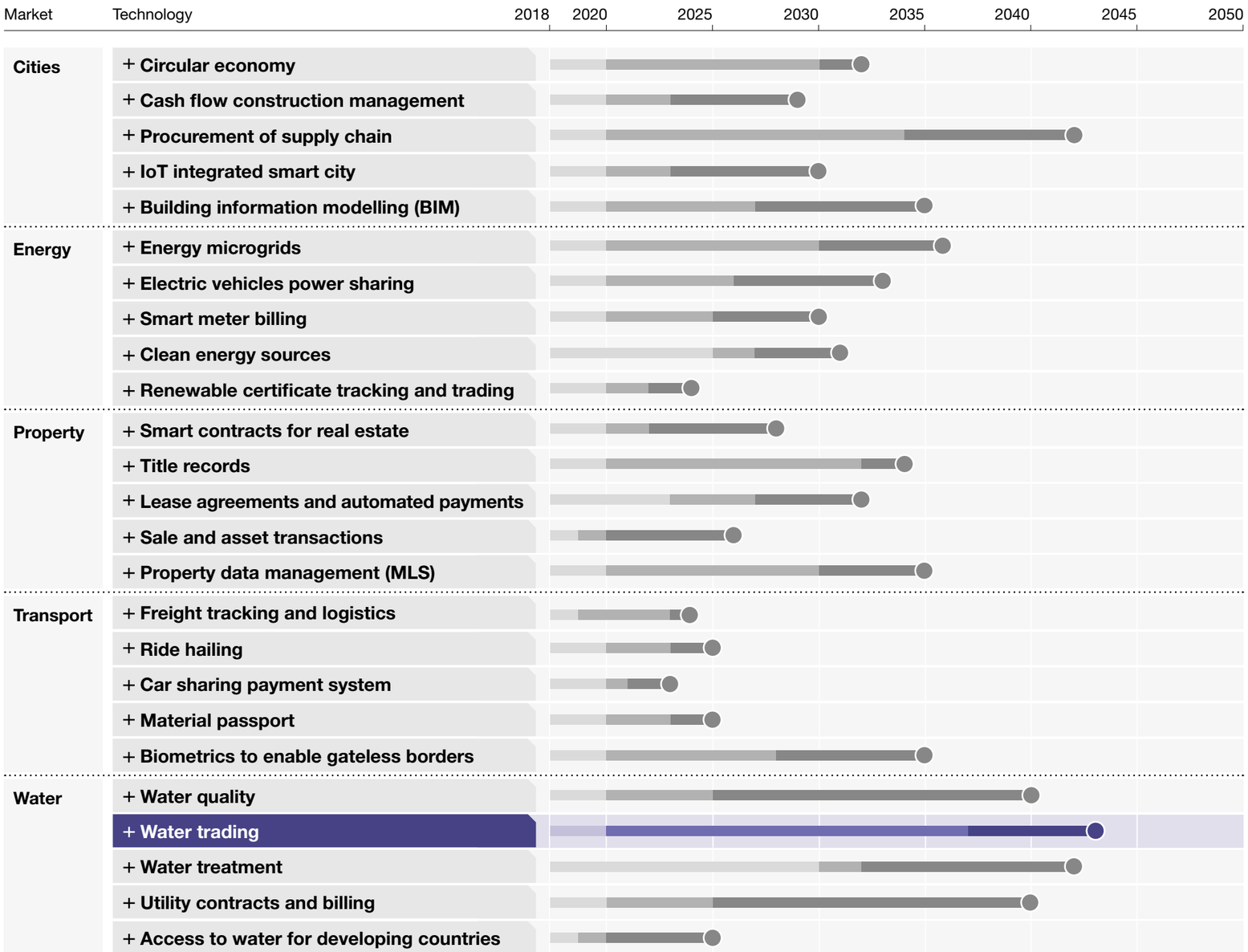
Relevance

Blockchain technology can improve trust and verification of environmental impact monitoring. Combined with smart sensor devices, blockchain will enable real-time access to environmental statistics, such as water quality measures, and allow live monitoring of environmental conditions. The system can provide access to historical water quality data on a tamper-proof blockchain ledger and give confidence in environmental quality data.

Case study

The Genesis Research and Technology Group in the US has developed a system to monitor fracking and groundwater quality.[28] The process uses temperature, conductivity, turbidity, dissolved oxygen and pH sensors to analyse water quality during the fracking process. These records are stored on the Ethereum platform, making it possible to track and verify water quality results. This significantly increases transparency, efficiency and accountability of the environmental impact of the fracking process. The future of fracking could be positive for the water industry.

Timeline



Water trading

Definition

Water trading allows water users to buy and sell water resources to respond to supply and demand. It involves buying and selling water access entitlements, often referred to as water rights. Water trading is typically a complicated and opaque process governed and managed by the cooperation of various government agencies, each with its own processes and rules for allocating water. This can increase barriers to trade, create an unclear pricing structure and cause restrictions within the trading market.

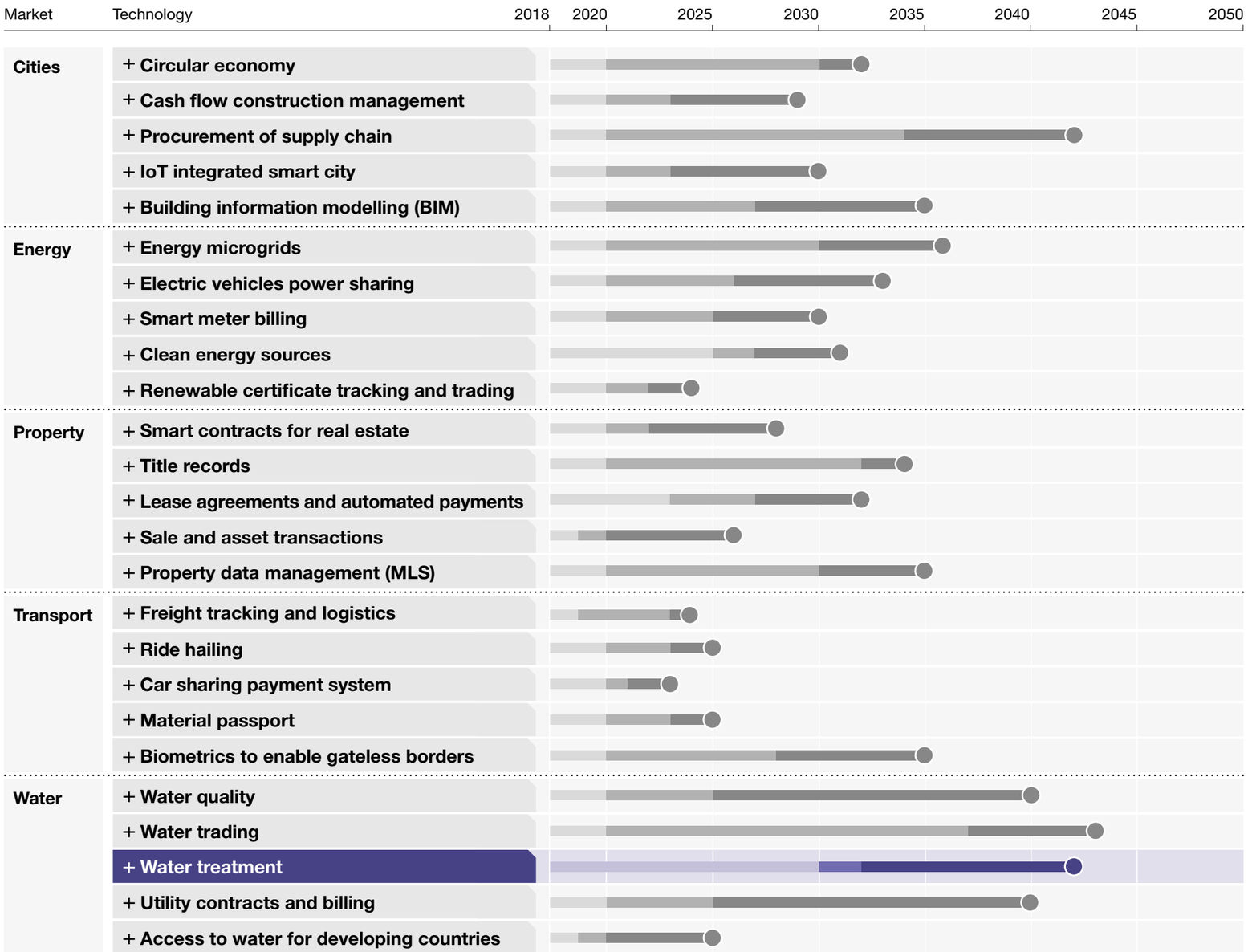
Relevance

Blockchain technology can streamline processes in the water trading industry by improving current practices in record management, identity management and transaction processing. A blockchain-enabled system could allow real-time monitoring and auditing of water trading activity, and improve security and efficiency in regulatory compliance requirements. Regulators would then be able to respond quickly to activities in the water trading market and automate transactions through smart contracts to reduce the time required to settle transactions.

Case study

Civic Ledger, an Australian civic blockchain start-up, has developed a peer-to-peer platform that uses the technology to monitor trading and update state registries.[29] Currently, water trading is the shared responsibility of five state governments. The start-up is working with agencies to track the transactions between parties. The government clients are: Queensland Government, Federal Department of Agriculture and Water Resources and IP Australia. This platform removes the need for intermediaries and reduces the potential for fraud.

Timeline



Water treatment

Definition

Water treatment improves the quality of water for its intended use. Uses include: domestic (drinking and cooking), agricultural (farming and fisheries), industrial (manufacturing), recreational (swimming and sailing) and hydropower generation. As an example, wastewater is treated in a wastewater treatment plant by removing and breaking down the pollutants in the water to produce a quality of water that can be safely returned to the water cycle with minimal impact on the environment.

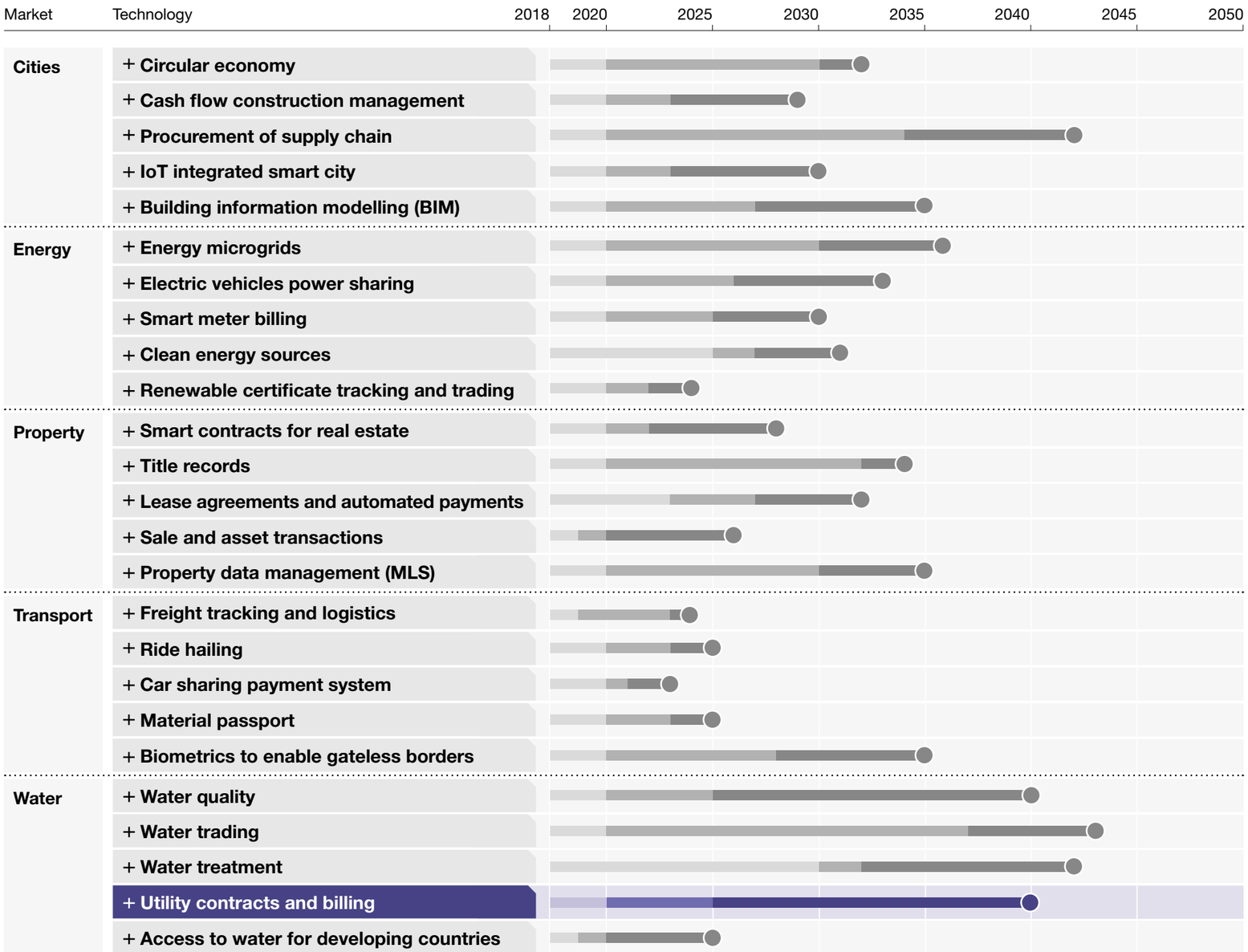
Relevance

Blockchain technology can be used to garner funds to develop and deploy water treatment. It could be used for tracking water source and water end-use/water users, and for fundraising initiatives for capital deployments, procurement and contracts.

Case study

OriginClear, a water treatment technology provider, is creating a blockchain protocol called WaterChain to address the water crisis.[30] The aim is to create a platform to improve water quality worldwide and reduce the number of deaths caused by unsanitary water conditions. The platform allows investors to take a stake by buying tokens to fund water recycling projects and receive a return. WaterChain is an attempt to create new funding opportunities for water treatment facilities.

Timeline



Utility contracts and billing

Definition

The water utilities industry is quickly evolving to meet the demands of a dynamic, highly deregulated and competitive market. As more and more customers have smart meters, the demand for transparency increases because customers want to know exactly what they are paying for and how they can make smarter decisions to reduce their costs. Customers want to understand how charges are broken down in terms of distribution system maintenance, cost of delivery, cost of usage and cost of commodity.

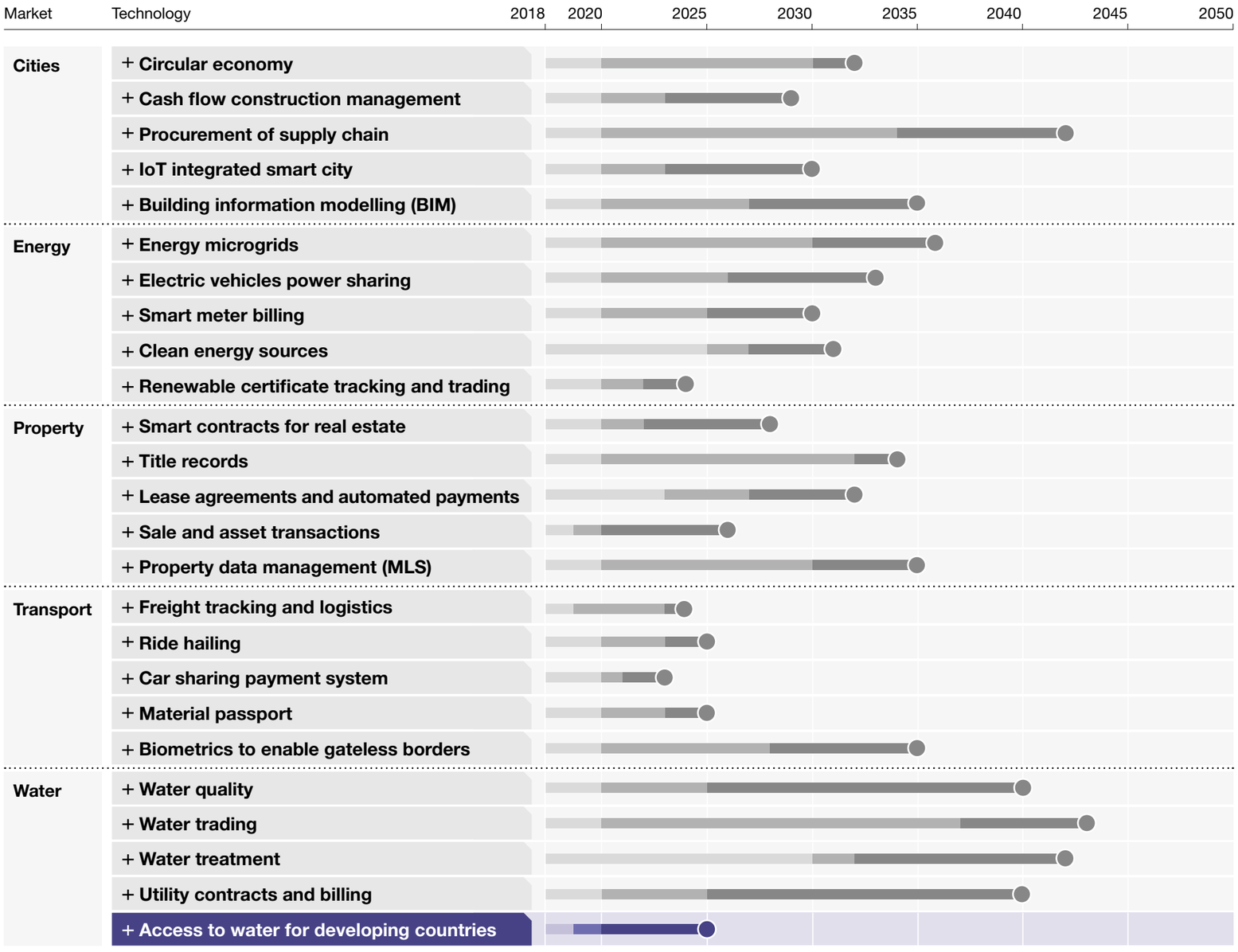
Relevance

Blockchain can improve auditability and traceability in the water market through smart contracts and billing reconciliation. Blockchain algorithms and structures — initially developed for the financial services sector — are increasingly used in applications for the water industry. The technology can connect all industry parties to share a public view of a register suitable for recording transactions and automating payments and processes through blockchain.

Case study

Product maker Treon has launched an Ethereum platform aimed at the utility market for the payment of utility bills through a mobile app and digital wallet set-up.[31] The platform enables consumers to settle their utility bills using a token through a one-click experience, making it faster to pay bills. The customer will get loyalty points in return as a reward and can redeem them towards favourable or preferred consumption rates.

Timeline



Access to water for developing countries

Definition

Globally, 663 million people live without easy access to clean water and 2.4 billion people lack access to improved sanitation facilities.[32] Access to clean water, good sanitation and hygiene can transform lives. It is estimated that 3.36 million children (the majority of whom are girls) and 13.54 million adult women were responsible for water collection in households with collection times greater than 30 minutes.[33] One of the United Nations' Sustainable Development Goals (goal 6) is to ensure the availability and sustainable management of water and sanitation for all. The targets are set for 2030 to achieve universal and equitable access to safe and affordable drinking water.

Relevance

NGOs can apply blockchain technology to create a robust and comprehensive decentralised platform that restores transparency and ensures judicious use of charitable project funds. A blockchain-based token can allow people from all over the world to donate money in support of clean water initiatives across the globe. The utility token can be used within the clean water initiative ecosystem to show where the charitable contributions are invested and towards which project.

Case study

Fintech company BANKEX has established a WaterCoin pilot project in Kenya, which provides clean and potable water to families from donations around the world.[34] The project provides 10,000 litres of clean drinking water per month to more than 1,000 people in the area. Using blockchain technology, BANKEX has eliminated the middlemen ensuring that relief efforts are felt directly by those in need. The project was launched in June 2018 to test the WaterCoin ecosystem. People anywhere in the world can donate by purchasing WaterCoins with the option to specify how they want their donations allocated.

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